THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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TWENTY YEARS OF ELECTRICITY SUPPLY.

THE paper read before the Society of Arts last week by Mr. Frank Bailey was of exceptional interest, as a review of the progress made in London during the 20 odd years which had elapsed since he read his previous paper before the Society—a period which covers practically the whole history of electricity supply on the commercial scale. It is almost exactly a quarter of a century since the passing of the second Electric Lighting Act removed the prohibitive restrictions which had been placed upon the embryo industry, and enabled capital to be adventured in this new field with a reasonable prospect of securing an adequate return. If we transport ourselves back in imagination to the date of the first paper—1890—what a striking contrast is presented between then and now!

At that time we were emerging from what Mr. Swinburne aptly described as the "postage-stamp paper and sealing-wax" stage of electrical engineering, when a 300-KW. dynamo was a monster, the Willans engine was asserting its supremacy, and various "battles of systems" were raging—between direct coupling and belt-driving, high speed and low speed, two-pole and multipole types of dynamo, A.C. and D.C.; high voltage was then 2,000 volts, and transformers were commonly installed on consumers' premises, while alternators were run on separate feeders, as parallel operation was considered, if practicable at all, too risky. The supply of electricity for motive power was practically non-existent, and there were no trolley tramways in the country—though there were electric railways!

To-day, on the other hand, we hear of the construction of a 25,000-KW. Parsons turbo-alternator without raising an eye-brow, and the cutting-off of the electricity supply of London for a single hour would be a disaster of national importance.

No better exponent of the past 20 years' progress in London's electricity supply could be found than Mr. Bailey, who, as engineer to both the City of London Co. and (formerly) the Metropolitan Electric Supply Co., has a unique acquaintance with the history, published and unpublished, of the subject, and himself was responsible for a very large share in the development of the industry in London. It is interesting to note that, by introducing the Parsons turbine into central-station practice in London, in order to overcome the vibration nuisance arising from the use of reciprocating engines in a residential quarter, Mr. Bailey gave a great impetus to the development of the turbine at a time when it was viewed with suspicion and incredulity by many of his *confrères*, and thus rendered timely service of the utmost value to Sir Charles Parsons—besides solving his own difficulties. That his confidence in the ability and genius of

that great inventor is unabated is well illustrated by the fact that he has ordered for the Bankside works a geared turbo-generator of the largest output yet constructed for direct-current supply.

The importance of the industry to London may be gauged from the tabular statement of the capital expended upon it and of the annual output which is given in our abstract of the paper on another page. That this huge business, engaging a capital of 21 millions sterling, should be split up between no fewer than 14 local authorities and 13 companies is, to our mind, a misfortune, attributable partly to the fact that the industry is of so recent origin that it has not yet grown out of the chaos of systems and supplies that reigned at the commencement, partly to the craze for municipalisation which overwhelmed the country towards the end of last century, and partly to the allied jealousy of private enterprise which gave rise to the ill-omened Act of 1882, and to the establishment of competition by the Government throughout the Metropolitan area in 1889. In the latter portion of his paper, Mr. Bailey contrasts the London conditions with those obtaining in Berlin, Paris and Buenos Ayres, to which might be added many other great cities, such as Chicago, Montreal, &c.

The advantages of centralisation of management and uniformity of system in the hands of a single authority, under statutory control, are hardly if at all less patent in the case of electricity supply than in that of the telephone system; and while we do not advocate the municipal management of any great commercial undertaking such as these, we believe that unification of the supply of electricity in London would tend to lower the price to the consumer, while ensuring an adequate return to the investor and guaranteeing a continuity of supply unattainable under existing conditions. But it will be the work of many years, and we hardly anticipate that it will be complete even when Mr. Bailey reads his third paper before the Society of Arts in 1933—as we sincerely hope he will do. May we be there to hear him!

Smoke Abatement. The annual meeting of the Coal Smoke Abatement Society was held on April 10th at the Royal United Service Institution. There was a time when this Society displayed something other than affection for electric generating stations, and we were inclined to feel that in pursuing its policy of relentless persecution of electrical undertakers, it was blind to the support that electricity supply was lending to its movement by providing power which would render multitudinous furnaces and factory chimneys unnecessary. To-day, however, the Society appears to be full of appreciation of the work of the London electricity suppliers. Indeed, reference to a note elsewhere in this issue will show that "the value of this, their ally, in the work of cleansing the atmosphere" is now gratefully acknowledged. In regard to the general course of smoke abatement, it cannot be said that the progress towards better ideas on matters of combustion is very rapid, yet in some way or other black fogs certainly seem to be less frequent than they were 20 years ago. It is a matter for regret that the income of the society should be less than £300 per year, for the society deserves encouragement from us all. What is needed by way of better methods for burning coal is not the use of anthracite, which some seem to think is the one and only way, but the use of methods for burning all fuels in a cleanly manner. It is to be hoped, however, that the semi-coke made from bituminous coal may, before long, be a regular article of sale. Coalite seems to have gone altogether. But what of that system by which ordinary gas coke was annealed in some way when freshly drawn from the retorts? To our knowledge that coke was an excellent fuel; it ignited as easily as coal, made a nice clean fire, produced no smoke, and yet gave a fire more like coal than coke. It was also economical. Of course, coal should never be burned until it has been at least partially coked and the by-products saved. But that is a large question. The domestic chimney should be less an offender to-day in consequence of the developments of gas and electric heating and cooking, and hopeful electrical men look in this direction, perhaps, more than in any other, for the clean and sweet, because smokeless, city of the future.

American Heating Loads. An American contemporary recently gave some interesting particulars of the electric heating load connected to the mains of the New York Edison Co. In 1900, this load amounted to 200 KW.; by 1907 it had increased to 800 KW., and, at the present day, it amounts to some 3,000 KW.—a figure which has, however, been exceeded in the Marylebone (London) area. Naturally, it is the electric iron which has come into favour most readily, and such is its popularity that the average energy consumption per iron used in tailoring establishments in 1912 reached the remarkable figure of 350 KW.-hours—an amount greater than the total annual consumption of many, if not most, middle-class lighting consumers in this country.

Our Chicago namesake states that nearly 700 additional electric irons were placed in New York factories last year by the Edison Co. alone, and it is known that 98 per cent. of these are in regular use. An installation of six irons is reckoned to be a small one, yet it secures a very acceptable annual revenue, and there are many larger installations bringing in from £100 to £300 per annum. With such figures before us, there can be no doubt that electric irons are as valuable to users as their demand is to the central station.

Prominent among the other industrial heating loads supplied by the Edison Co. are several large japanning ovens, the efficiency of which has been greatly increased by the adoption of electric heating. During January, 1912, the ovens in one establishment consumed 882 KW.-hours. Recently electric heating has been adopted in connection with celluloid button dies, and in the better millinery and dry goods establishments there are a number of electrically-heated boilers used for steaming velvet and feathers.

Similar installations have recently been put in by large theatrical companies using a multitude of costumes. Electric sealing-wax heaters are working six days a week in many large offices, electric branding irons have gained greatly in popularity within the past year, and soldering irons and pitch kettles make a steady, if not startling, progress. Cinema film companies are now using electric heaters for their developing baths.

In domestic service in New York the electric iron averages 14 hours' use per month; the 6-lb. iron usual in resident flats averages 84 KW.-hours per annum. Special provision is made for the use of electric irons in the newer apartment houses; in one case, 35 tenants are each provided with two irons and an ironing board in an elaborate basement laundry, and complications are avoided by placing each iron on its own meter and locking the outlets. Among all kinds of domestic heating appliances, that for which the greatest increase in demand developed in New York during 1912 was the "combination grill," comprising a series of cooking utensils capable of being used with a single heating unit.

The Washington Water Power Co. (Spokane) has an industrial heating and power load of 77 per cent. daily load factor, to which, as we gather from the American *Electrical Review*, there has recently been added an electric heating installation in the banana ripening rooms of the Chas. Uhden Co. Each of two rooms, 16 × 18 × 7 ft., accommodates 200 bunches of fruit, and is heated by four 500-watt car-heaters mounted in an asbestos-lined wall box. In addition, a 500-watt heater is placed in a bucket of water to provide the requisite atmospheric moisture. A circulating fan is placed in each wall box at the outlet of an air duct, which has its inlet at the floor line on the opposite side of the room. Cool air is thus drawn in and blown through the heaters on to a distributing board. Experience shows that this system of heating enables a uniform temperature to be maintained in every part of the room without the aid of a thermostat. At night, the fan and half the heaters are shut down, an even temperature within 0·5° F. being then maintained during the night. In summer, the heat generated by the ripening fruit is greater than is required for best results, hence ventilating ducts are opened, and (the heaters being idle) the fan is used to circulate cool air through the ripening rooms. By working the rooms alternately, a high load factor is obtained, and 200 bunches of fruit are available for market every two days. The nature of the load, from the central station standpoint, will be seen from the following data :—

1912.	Max. demand. KW.	KW.-hours.	Load factor.
March	1·7	1,100	87 %
April	1·2	800	92·5 %
May	1·2	840	94 %
June	1·2	90	10·2 %
July	1·2	60	6·7 %
August	1·2	75	8·4 %
September	1·5	240	22·2 %
October	1·4	450	43·3 %
November	1·9	900	65·8 %
December	2·3	1,150	67·2 %

Expert Witnesses in Patent Cases.

In the case of Crosfield *v.* Techno-Chemical Laboratories, Ltd., which was really a contest between the two great firms of Mond and Lever, Mr. Justice Neville had something important to say about the functions of the expert witness. One has only to peruse the headnote or summary of the case which appears in the *Times* "Law Reports," published last week, to see that it was a dispute in which the services of experts were urgently needed. That summary is as follows : "The plaintiffs, as legal owners of letters patent granted to one N. for 'a process for converting unsaturated fatty acids, or their glycerides, into saturated compounds,' alleged that the defendants were infringing their letters patents, and they claimed an injunction and the usual ancillary relief. The defendants denied the validity of the letters patent, on the ground that N.'s specification did not sufficiently describe the manner in which the process was to be carried out. It was held that the specification was insufficient in this respect, and that the action failed." It is obvious that a dispute about such a patent must have involved the employment of experts—if only to explain to the Court the meaning of the technical words used ; but it is evident that in the view of the learned Judge the experts engaged exceeded their functions. In the course of his judgment he said :—

"It is not competent in any action" for witnesses to express their opinion upon any of the issues, whether of law or fact, which the Court or a jury has to determine. The assistance of expert evidence in patent actions is generally essential. It is required for the purpose of explaining words, or terms of science or art, appearing in the documents, or to inform the Court in case the import of a word or phrase differs from its popular meaning. Further than this, in some cases it is impossible for the Court to understand a document without instruction with regard to the laws of the science with which the patent may be concerned, without expert assistance. Moreover, the Court cannot inform itself as to the state of public knowledge with regard to the matters in question at the date of the patent. The above category may not, indeed, be exhaustive ; but in no case, in my judgment, is it permissible to seek the opinion of a witness upon any of the issues in the action, or the construction of any document relied on. Yet I believe if the records of patent actions during the last 20 years were examined, it would be found that a very large proportion of their contents, I should say at least nine-tenths, is devoted to questions which, either openly or under more or less skilful disguise, are directed to eliciting the opinion of the witnesses upon one or other of the issues in the case, or the construction of documents relied upon.

Anyone who has been concerned in a patent case will readily admit the force and truth of these observations. The expert witness necessarily becomes imbued with the merits of the case he is asked to support, and finds it difficult to avoid the expression of an opinion as to whether a particular invention has or has not been infringed or anticipated. But while it is easy to point out the symptoms of a disease, it is not always easy to prescribe a remedy. Under our present system of judicature by which technical cases of the highest order must be tried before a tribunal which may, scientifically speaking, be wholly ignorant, the assistance of expert witnesses is essential. For some reason which is difficult to explain, the judges almost invariably refuse to summon a scientific assessor whose opinions on technical matters would be of the utmost value. True, the parties to a patent action can retain the services of counsel who have much scientific knowledge ; but the opinion of the counsel is only argument when heard in court. Some of us, perhaps, may live to see the day when there will be a special tribunal for the determination of patent cases before which the services of expert witnesses may be entirely dispensed with.

Invention in 1912.

The annual report of the Comptroller-General of Patents shows that among the predominant lines in which there was evidence of inventive activity during 1912 were the following :—Internal combustion engines and other motor-car matters, including the construction of small dynamos for motor-car lighting ; life-saving appliances for use at sea, inventive ingenuity apparently being markedly encouraged by the *Titanic* disaster (means for preventing collisions and detecting the presence of ice, also arrangements for enabling wireless signals to be received when the operator is off duty are mentioned in this class) ; and automatic telephone exchanges—especially the difficult problems of junction and trunk line working, and semi-automatic and other methods for facilitating the gradual introduction of automatic systems. Legislation which gave rise to a great public controversy also led inventors to find new appliances for obviating the necessity for wholesale stamp-licking being carried out on the orthodox lines ; while the public appreciation of the cinematograph made this comparatively new department a popular one among patentees. In regard to the general figures of the year, the number of applications was 30,089, as compared with 29,353 in the previous year ; provisional specifications were 19,825, and complete 18,853, while 15,814 were sealed, these figures in 1911 being 19,524, 18,662 and 17,164 respectively. The receipts from patents fees were £293,529, showing an increase of £10,325 for the year. In designs and trade-mark fees there were increases of £441 and £3,369 respectively. There was a decrease of £379 in the sale of Patent Office publications. The total expenditure on behalf of the Office showed a decrease of £3,140, and the net financial result of its entire operations is a surplus of receipts over expenditure amounting to £131,627 ; this is an increase of £16,896, as compared with the 1911 surplus. It appears that there is an increase in the number of applications received from the United Kingdom and from Canada, India and the West Indies, but those received from the Australian Commonwealth, New Zealand and the South African Union, showed a considerable decrease. In respect of ten foreign countries (included here is the United States), there were increases, but six Continental countries—Belgium, France, Germany, Hungary, Russia and Sweden—sent fewer applications than in 1911.

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ELECTRODES FOR ELECTRIC FURNACES.

By G. BASIL BARHAM, A.M.I.E.E

For some reason in electric furnace work, not only the actual electrodes themselves, but also the end connections which are used to connect the cables from the supply to the heating resistance are frequently termed electrodes, although this term could only be applied in the correct sense to these terminals when the resistance was of an electrolytic nature. Generally speaking, the name is given to the carbon or metal bodies which, together with the charge, form the primary essentials for almost every form of electric furnace yet devised.

The best material for electrodes from the point of view of conductivity is graphite. Usually ordinary carbon is employed, as all forms of carbon decrease in resistance as the temperature to which they are heated increases, being in this respect the exact opposite of most of the so-called rare metals—such as those used for lamp filaments. Carbon, further, can be raised to a higher temperature than can any other substance suitable for use as electrodes. Unfortunately at high temperatures it will readily enter into combination with certain metals—tungsten and molybdenum in particular—forming carbides. Carbon electrodes at high temperatures also act as reducing agents unless they are properly cooled, and it may be said that the problem of effectively cooling electrodes without allowing heat to flow from the hot end of the electrode to the exterior of the furnace is not an easy one to solve. If metal electrodes are employed in order to avoid the troubles which may result from the use of carbon, they also must be effectively cooled or they will dissolve or volatilise. When metal electrodes are used it is customary to form them of similar metal to that about to be treated, so that should any part of them be dissolved, the smelted metal would still be in its original form and not in that of an alloy. It will be remembered that Ferranti, Héroult and Kjellin devised means whereby the work of smelting could be carried out without electrodes or without such electrodes as were used coming into actual contact with the metal which was being dealt with.

It has been mentioned that one method of preventing the escape of heat to the outside of the furnace is by cooling, but it will be evident that much depends on the proper proportioning of the electrodes themselves to the current which will be passed through them, and by which the interior portion is raised to the required temperature. This question was thoroughly gone into a short time ago, and it was found by experiment that many of the rules formerly used for designing electrodes were quite incorrect. It was proved that current density was not a determining factor in the design of these parts, and that the resistance was determined by the conditions and not to be considered as merely a matter of choice. The conditions determine either the length or the section of the electrode, and it is only the ratio of the section to the length which is the determined factor. Neither the thermal conductivity nor the electrical resistivity is a governing factor, but it is their product and quotient which are the true measures of the qualities of electrodes. The quotient of the thermal over the electrical conductivity is proved to determine the loss, while the product of the two resistivities determines the proportions, hence it is not necessary to know either one or the other of these properties, but only their quotient and product. It was furthermore shown that these are more easily determined than the others. These two quantities lead to some new quantities not hitherto used, but by means of which the calculations of electrodes become simple in the extreme. These two quantities are termed the loss and the size factors.

Hering has tabulated these for each of various temperature ranges. The loss factor, called "watts per ampere," when multiplied by the current, will give the loss in watts directly, whilst the size factor, called "section per ampere per sq. in." when multiplied by the current and by the length, gives the cross-section in sq. inches.

A problem, which has been the subject of considerable attention, has been in regard to the terminal connections to the electrodes. It appears useless to clamp the electrodes into metal holders; or to use clamping bands, plates, couplings or caps. The metal expands much more than does the carbon as the temperature rises, with the result that the metal attachment works loose, and local heating, which may have disastrous results, sets up. A metal rod, carrying a terminal attachment, can be used for the purpose, one end being morticed or sunk into the carbon electrode. It is important, however, that this should not be too tight a fit, as otherwise, when the metal expands, it will burst the end of the carbon rod or block. In one form of terminal a metal rod, which is enlarged at its bottom end, is passed into a hole in the carbon which has been undercut so that whilst it is large inside, the mouth of the hole will only just permit the thickened end of the rod to pass. When the thick end of the rod is pushed to the bottom of the hole, thin metal plates are slipped down beside it, with the result that when an attempt is made to withdraw the rod, the plates jam it in place. This makes a sufficiently good electrical connection, and one further which allows of expansion, the metal rod sliding slightly down the inclined plane made by the metal strips, as it expands under the heat conducted through the electrode.

Common coke, as obtainable at any gas works, is quite suitable for electrodes in the majority of circumstances, and has the advantage of costing but little. In the production of calcium carbide, aluminium, or carborundum, such electrodes answer the purpose admirably in every way, especially if the coke is first picked over, and the light and more porous portions removed. A good carbon for low-tension work is made of a mixture of 25 per cent. of gas coke, and 75 per cent. of petroleum coke. This latter is a by-product of the oil distilleries, and at one time was the only kind that was largely used in the manufacture of carbons for electrical purposes. The only other constituent for the best quality of electrodes is pitch, obtained from the distillation of tar. A common pitch obtained from blast furnaces, but which is far from pure, being contaminated with iron compounds, can be used, but it is not nearly so suitable. At the same time it is not easy to get the desired quality of pitch from the distilleries. The quality depends on the freedom of the pitch from anthracene oils, as when it contains these it is what is technically termed "wet," an expression the meaning of which is self-evident. To get it properly dry all the oils must be driven out, and few still owners care to expose their plant to the high temperatures, which have to be kept up for a long period, in order to drive off the whole of these oils.

In the manufacture of electrodes the coke is first crushed to the size of coarse gravel, after which it is heated to incandescence in a sealed retort, which is provided with a few vents to permit occluded gases to be driven off. After withdrawal from the retorts the coke is ground to fine powder and conveyed into storage bins. The pitch is first broken by hand and then passed through machines which break it up into fine granules. The coke and pitch are then accurately mixed, and it is on this mixing that the quality of the resultant electrode depends. It is carried out in a cast-iron cylinder containing an independent shaft, which is fitted with arms which drag the material from the sides of the drum as fast as it is thrown there by centrifugal action, and bring it back to the centre. After undergoing this treatment for some time, the mixture is spread out and allowed to solidify, after which it is again broken up and pulverised in a mill. It is then finally pressed into moulds, which are the shape of the required electrodes, and baked to render the pitch-coated particles of coke thoroughly adhesive. As soon as the required degree is reached the mould is placed in a hydraulic press, and a pressure of several hundred tons brought to bear upon it.

Electric Laundry Irons.—In view of recent correspondence on the subject of laundry irons, the British Prometheus Co., Ltd., of Birmingham, inform us that they are now making a speciality of a new type of laundry iron, which has been expressly designed to obviate the defects mentioned. They are so confident of the utility and long life of this iron that they are willing to submit samples for approval to laundry engineers, some of whom have already tested them with complete satisfaction. The guaranteed life of the new Prometheus laundry iron is three years.

THE LIGHTING OF SMALL COUNTRY HOUSES.

By J. CALDWELL.

It is now generally recognised that electric lighting cannot be surpassed for use in large country houses, and in the technical Press many interesting descriptions of extensive installations for electric lighting and power duty appear from time to time.

The expense of carrying out such comprehensive schemes is, however, considerable, and often exceeds average requirements in the country where castles and large mansions—many of which are already provided with electric light—form a very small proportion of the residences where the installation of private lighting plants is now being considered.

It is in these small or moderate-sized country houses that one sees the keen rivalry between petrol air gas and electricity for supremacy. The exponents of each system endeavour to convince the prospective customer as to the advantages of their system, and also to give all information of disadvantages and dangers, whether real or non-existent, that are reported regarding the rival system. Figures are given to prove the superiority and wonderful economy of either illuminant, and as these particulars are often misleading with reference to the standards of comparison they prove damaging to both systems, as the customer ultimately finds out the true facts for himself, and although the results of work may be entirely satisfactory, they prove disappointing in view of previous assurances.

Both illuminants are particularly satisfactory and efficient, and can claim to be convenient, cheap and simple to operate when compared with oil lamps, coal or acetylene gas. Electrical plants have already proved durable and reliable in the performance of their duty, and although petrol air gas plants have not yet ceased to get out of gear periodically, it may be expected that this trouble will soon be eliminated when manufacturers realise the advisability of increasing the strength and improving the design of the machine parts with a view to providing efficient service rather than cheap equipments.

Hereunder we give comparative particulars of two existing typical installations of petrol gas and electric light. These were erected two and four years ago respectively, and are chosen from amongst installations representing the nearest similar capacity and duty in which the writer is interested. The gas plant has practically no storage accommodation, but operates automatically to supply the lighting demand, whereas the electric plant has a storage battery which is charged for a few hours each day, and a longer period on Saturdays in winter, but less frequently in summer months. The maximum capacity of the gas plant is 100 burners, whilst the electric plant when working under the same conditions with combined supply from dynamo and battery could be connected to 82 lamps for 10 hours and a maximum of 112 lamps for one hour without recharging the battery.

These conditions, however, do not occur in usual practice, and the average number of lamps in use at any one time in the two small installations under consideration does not exceed from 30 to 50 lights.

Petrol Air Gas.—The necessary quantity of petrol is introduced into a tank in the generator containing water, which is aerated by a revolving stirrer during admission of the spirit; petrol air gas is emitted and distributed to burners throughout the house by pressure obtained from a weighted gas-holder fitted to the machine. The correct proportion of petrol admitted to the tank is measured in a small bucket placed inside the generator, which admits the desired quantity into the water, depending on the rate of gas consumption.* The distributing pipes are made of iron or block tin, sufficiently large to pass the requisite amount of gas to the burners without loss of pressure, and taps are connected to the bottom of vertical pipes as found advisable to drain away any condensed water that accumulates. The initial cost of this installation was as follows:—

Generating plant with accessories	£102	10	0
Piping, &c., in house	63	0	0
Fittings	0	0	0
	£165	10	0

Electric Lighting.—The generating and storage plant is accommodated in an outhouse, and consists of a petrol-paraffin engine direct coupled to a shunt-wound dynamo with switchboard and a storage battery.

The "Rational" engine, manufactured by the Heatley Gresham Engineering Co., Ltd., develops 1·6 B.H.P. at constant working load, with fuel consumption of ·8 pint per B.H.P-hour, on paraffin fuel having a specific gravity of ·825 at 62° F.

The engine is fitted with magneto ignition, and when started cold, is run on petrol until the vaporiser is sufficiently heated—in about five minutes—to allow of paraffin being used.

The interconnecting pipes between the engine, oil and water tanks and exhaust silencer are laid in trenches in the floor neatly covered with checker plating fitted with iron frames.

The dynamo gives 40 amperes, 25-40 volts at 800 R.P.M., and is mounted with the engine on a combined bed-plate.

The switchboard is recessed into the partition wall between the engine and battery rooms, thus providing easy connection to the cells, whilst the back of the switchboard is enclosed as a protection against acid fumes.

The battery, made by the Chloride Electric Storage Co., consists of 14 cells capable of supplying 32 16-C.P. metal-filament lamps continuously for 10 hours.

Wiring, &c.—Bitumen cables, contained in wood troughing filled in with pitch and covered with tiles, are laid underground from switchboard to house and two avenue lights.

The branch wiring throughout the house is of V.I.R. 2,500-megohm grade conductors contained in solid-drawn steel tubes sunk behind walls and ceilings.

The work was carried out by Messrs. Steel & Wilson, Glasgow, to the specification of James E. Sayers & Caldwell, Glasgow, and the total cost is summarised below:—

Generating and storage plant	£90	12	9
Switchboard and connections	17	0	0
Underground cables	11	11	0
Wiring for 68 lamps and 62 switches ...	57	16	0
74 metal-filament lamps	9	5	0
Alterations and extras	11	10	5
Fittings	10	0	0
	£207	15	2

The fittings for gas and electric light are not included in the above comparative costs, as the amount spent on these depends on the design and class of fittings selected, which varied in both these installations.

The gas consumption for each burner is 9 cb. ft. per hour. Petrol of ·68 specific gravity at 62° F. as recommended by the makers of the gas plant is at present 2s. 1d. per gallon, and as this quantity generates 1,300 cb. ft. of gas, the cost of petrol per 1,000 cb. ft. will be 1s. 8d.

To start the engine, petrol of ·825 specific gravity is used which can now be obtained at 1s. 4d. per gallon, and paraffin for 7d. per gallon, equivalent to an average fuel cost of 8d. per gallon. As ·2 gallon of fuel is required per B.H.P.-hour, which is equivalent to about ·3 gallon per unit, the oil required per 16-C.P. lamp will be ·006 gallon per hour.

It is difficult to obtain reliable information for intelligent comparison of the upkeep of these respective plants on the same basis, but if we assume that 30 lamps are in use for 1,500 hours per annum, the annual charges will be:—

Petrol Air Gas.—30 × 1,500 × 9 = 405,000 cb. ft. gas at 1s. 8d. = £33 14s. 8d.

Electric Lighting.—30 × 1,500 × ·006 = 270 gallons fuel at 8d. = £9.

The proprietors of both plants have indicated that the accounts for petrol and oil during the last six months (September to March, 1913), which include the darkest days of the year, were £24 for the petrol-gas plant and £6 for the electric plant, so that it may be assumed that the above figures are substantially correct.

* In other air gas machines the petrol is contained in a small closed storage tank, from which it is automatically passed into a carburetter, when it is brought into intimate contact with air which has been dried by means of calcium chloride and is drawn through the carburetter by a small pump. The carburetter consists of a series of pipes arranged in zigzag form, and the petrol when admitted is passed through wire gauze, where it is broken up into fine particles and mixed with the dried air.

FILING ARTICLES FROM TECHNICAL JOURNALS.

By "WHISTLEFIELD."

Anyone who has made a practice of keeping his technical journals for future reference soon finds that the pile begins to assume unwieldy proportions, and when any article is wanted, it is a very difficult and often times dusty business to lay hands on it.

There is so much that is of purely momentary interest in most papers, that it is not worth the expense of binding them even if the amount of room required for storing the volumes was not a consideration. To make a neat job of a scrap book requires two copies of each paper to be bought, otherwise pages which are gummed down one side, or along the top to allow the letterpress on both sides of the page to be visible, will become torn in handling. In addition to the trouble of cutting out and mounting, is the further one of indexing, and unless the reader is of more than ordinary methodical habits, and has more time than he knows what to do with, the scrap book is sure to get behind and degenerate into a folder full of torn-out pages without method or index.

Another way is to take out the pages containing the letterpress that is wanted, score out with blue or red pencil the columns not required and bind the whole pages in some form of clip file or spring-back folder, numbering each page with blue pencil for the purpose of indexing.

This method is an improvement on the scrap-book from the time-saving point of view, but does not get over the difficulty of indexing, and unless the indexing is thorough and well done, the usefulness of the file is greatly reduced.

The following method for dealing with articles and other interesting matter published in the Electrical Review is one which works well and requires so little time to keep up to date that perhaps it may prove of interest to those who have not yet got a working system.

A Stolzenberg or other similar file, foolscap size, with a loose flap, so that the first paper filed always remains on top, is procured, and each week every page of the Review which has anything of permanent value is torn out and inserted in the file, care being taken that the numbers of the pages run consecutively—that is, if pages 300, 304 and 310 are kept one week, they are filed in the order given.

In the first or second week of January and July there is a very complete index of the contents of the paper for the previous six months, published as a supplement to that week's issue; this is removed intact, and placed in front of the file containing all the pages referred to in that index.

All the articles retained and filed are now underlined in ink in the index, and, of course, the page number given in the index corresponds with the number on the page filed, and these numbers run in consecutive order in the file. A careful examination of the index will also show if any papers of value have been overlooked, and these can now be added to the file, and the remains of the issues destroyed.

It does not take more than half an hour every six months by this method to get a completely indexed useful file of technical data; and as the Review index is grouped under sub-headings also, the system is as thorough as one could wish for.

The same method, of course, could be adopted with regard to the articles of any periodical which issues an index to each volume.

Anglo-German Exhibition in London.—From May to October, 1913, there will be an Anglo-German Exhibition in progress at the Crystal Palace. We have received a copy of a pamphlet prepared for the instruction of prospective exhibitors, and full particulars can be obtained from the administrators of the Exhibition, Empire House, 175 and 176, Piccadilly, London, W. The list of exhibits includes machinery and tools; lighting, electricity, gas, &c.; mining; transport, railways, tramways, &c. Money prizes, aggregating £2,500, are to be awarded for the best decorated stands. There will be an Anglo-German club in the grounds, and various sports and other amusements will be arranged for. One of the great objects of the promoters will be to cultivate a more friendly feeling between the two nations.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Failure to Excite.

In reply to "Speedometer's" letter on the above subject in your issue of April 4th, I would suggest that the trouble is due to the shunt winding being reversed.

It is a well-known fact that a shunt wound generator will only excite, if the field winding is so connected that current generated in the armature assists the residual magnetism, and builds up the field.

To find if this is the cause of the trouble, the generator should be run in the reverse direction. Should the machine still fail to excite it will be due to the field being totally demagnetised, or slightly magnetised in the wrong polarity.

The machine should be run for a short period as a shunt motor, after which if it is run in the opposite direction as a generator, it cannot fail to excite.

H. P. Bramwell.

Glasgow, *April 12th*, 1913.

[We must point out that a shunt machine runs in the same direction whether as motor or as generator. Still, Mr. Bramwell may have put his finger on the trouble; possibly "Speedometer" drove the machine in the wrong direction.—Eds. E.R.]

Long-Scale Instruments.

My attention has been drawn by several friends to advertisements and descriptions in various electrical journals of the long-range ammeters and voltmeters of Messrs. Record & Co., and I would ask your kind permission to express my view with regard to long-range instruments generally.

In this expression I do not desire to reflect in any sense on the design of the instruments of Messrs. Record. Writing purely from a personal point of view, I wish the firm success in their endeavour. There is, however, another aspect of this matter that must be taken into consideration, and it is this: that others also are manufacturing long-range instruments.

I think engineers will realise that the instruments now manufactured by Messrs. Record & Co. are essentially of the same type as those made as long ago as 1895 by Messrs. Muirhead & Co., and more recently by Messrs. Gambrell and Co.

It is not pleasing to me to have to write in this strain, but in justice to others now making these meters, it is well that your readers should know how the matter stands. I will be brief.

For the long-range type of meter, letters patent were granted to me in 1893. This type was subsequently described in a paper before the Physical Society of London, February 10th, 1899. Descriptions appeared also in the *Philosophical Magazine* for August, 1899, and in text-books and electrical journals. The instruments appeared in various forms, but all had scales varying in length from 220° to 295° of arc.

A long-range instrument was patented also by Mr. W. P. Thompson in 1897 (No. 22,851) having a range of 270° of arc. There is, therefore, nothing novel in long ranges. Letters patents were granted to Mr. Record in 1912, Nos. 3,454, 26,241 and 26,242.

The range of one of the 1893 meters is shown in fig. 1. It is in degrees, being an instrument designed for laboratory purposes. The length is 240° of arc. The figure is taken from Messrs. Muirhead's catalogue.

Moreover, the 1893 instrument was by no means the first meter possessing a long range. Prior to this there existed a French instrument of a similar type designed, I believe, by M. Carpentier. I was not aware of this till 1899, when Prof. Ayrton sent me a sketch of it drawn to scale. I cannot now put my hand on this, but my recollection is that the scale length was 250° of arc at least.

Mr. Record makes a claim in one of his specifications for the "ring-shaped" pole-piece. The "ring," however, is an

essential feature of all the 1893 instruments, as well as the Thompson instrument of 1897. Figs. 2, 3 and 4 show the pole-pieces of the three meters. Fig. 2 is taken from Mr. Aspinall Parr's book; fig. 3 is from the Thompson patent specification, and fig. 4 is from the Record patent specification No. 26,242 of 1912. All these possess the "ring-shaped" pole-piece, and all have long ranges.

Mr. Record, in one of your contemporaries (*Electricity*, January 10th, 1913), quite rightly lays stress on the plan of making two sides of his moving coil active, and then makes a comparison with the 1893 instrument, in which only

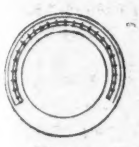

Fig. 1.

Fig. 2.

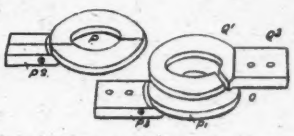

Fig 3

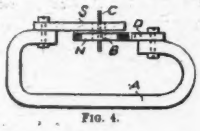

Fig. 4.

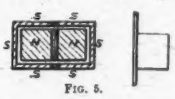

Fig. 5.

one side was active. He will find, however, on referring to the *Philosophical Magazine* for August, 1899, that I had arranged for the active use of even three sides of the coil. Fig. 5 is a reproduction of a cut published in that journal.

Again, in Mr. Record's patent specification the formation of a gap in one of the pole pieces, with the object of avoiding waste of magnetic flux at a certain area not swept through by the moving coil, is raised to the dignity of a claim. This gap, as every engineer would see at once, is purely a constructional necessity. In one of the forms of the 1893 meters, owing to its particular construction, that same gap was used, and is shown in the *Philosophical Magazine* for August, 1899, page 205. The gap is such an obvious necessity that one is somewhat astonished that it could ever have been thought of as a sufficient basis for a claim in a patent specification.

Benjamin Davies.

Enfield, *April 11th*, 1913.

Electric Laundry Irons.

It was with great interest that we read the remarks contained in your columns last week by "Ironical."

We have had considerable experience in electric, domestic and laundry irons, and we have tried all the well-known makes, but cannot find one that will give satisfaction for any length of time.

The troubles we experience are either the copper contact loosening inside the iron from the element, which seems to lose its nature by the close proximity of the heat, or the pins connecting the cable connector lose their tension and continually have to be renewed.

The flexible wire immediately on leaving the connector in a very short time frays and the rubber perishes and short circuits occurs if these are not attended to periodically.

We have tried all kinds of flex with the exception of brass flexible mentioned by your correspondent, and we certainly think there is a vast amount of room for some heating firm to devote their greatest attention to put on the market an electric iron that will get over this difficulty.

We shall be pleased to hear from any makers that they are in a position to supply us with these goods when the troubles complained of have been overcome.

J. E. Lester & Folwell.

Leicester.

Magnetic Survey.—The Terrestrial Magnetism Department of the Carnegie Institute is beginning a magnetic survey of New South Wales, which will be linked up with Dr. Mawson's work in Adelie Land.

THE PREVENTION OF ACCIDENTS IN ELECTRIC LIFTS.

[COMMUNICATED.]

A CONSIDERABLE number of cases which have recently occurred where passengers in electric lifts have been killed or injured has led to a stirring of interest in the question of the safety or otherwise of the electric lift, and it may, therefore, be worth while reviewing very briefly the conditions of the problem and the means which are adopted in order to secure as far as possible the safety of those using the lifts.

Considering, first of all, the method of control, the electric lift is operated either by hand rope, a switch in the cage or push buttons, and in each case there is the liability to trouble unless suitable means of securing safety are provided. Further, in any type of lift, especially where high speeds are adopted, there are dangers which can only be overcome by most accurate controls, preferably of an automatic nature. For example, it is very difficult to bring a high-speed lift accurately to rest in its proper position in line with the landing, and it is easy to see that a difference of an inch or two might, under certain circumstances, make the owner of the lift liable for any accident caused to passengers or intending passengers. Again, on a high-speed lift, unless automatic means for slowing down and stopping the lift at the top and bottom of its travel are installed, there is the danger that it might slightly overrun its path and cause damage either to the cage, the supports or the passengers. Due provision must also be made against the breakage of the rope, the failure of the motor or the brakes and any mechanical or electrical breakdown which would interfere with the safety and convenience of working.

A most important and serious class of accident arises in connection with the gates. If adequate precaution is not taken to have these properly closed when the cage is not in position on the landing, there is the danger of a passenger falling down the shaft or meeting the top of the gateway while the cage is rising, and thereby suffering severe injury. To ensure safety, automatic means must be devised for the closing of gates before the cage begins to move away from the landing, and it is towards this point that a great degree of attention has been directed.

Considering, for the moment, the problem raised in the former series of possibilities, it may be pointed out that strain on the ropes, over-running and similar troubles can be overcome by means of a suitable method of electrical control. The method of starting and stopping the lift by hand rope is, of course, the simplest and least costly, and can be applied either by hand ropes passing through the cage and controlled by an attendant, or by one rope passing through the cage and one rope placed outside the lift shaft altogether, and controlled by anyone desiring to use the lift. Safety is assured with this latter system, provided that the cage is fitted with barrier gates which either lock the starting rope mechanically or are electrically interlocked to prevent the cage from being started when loading or unloading is taking place. Where the lift is controlled by means of a reversing switch in the cage, terminal blocks are usually fixed one in the cage and the other half way up the shaft, to which is attached a multiple wire cable connecting the switch to the controlling apparatus, which operates electromagnetically, and is designed to effect a smooth starting and stopping of the cage at landings with the ordinary movement of the handle by the attendant, while, at the same time, the motor and apparatus are protected against breakdowns, even on heavy or frequent service, by good and substantial design and construction. At the top and bottom landings automatic stopping is provided.

In the case of push-button control it is customary either to use a panel of buttons at each floor, enabling the cage to be dispatched from any one floor to any other floor from either inside or outside the cage; or alternatively, there is only a single button at each floor, enabling the cage to be brought to that floor by touching the button and dispatched to any other floor from the inside of the cage only. In addition to the push-button panel in the cage containing the corresponding push buttons of the floors, there is also a lighting switch and emergency stop, while the control apparatus for starting, reversing and stopping the motor is

fixed near the machine itself. The emergency switches are actuated automatically if for any reason the cage overruns the top or bottom levels. Reference was made above to the possibility of the main ropes failing, and this is overcome by using duplicate adjustable slack additional wire rope to arrest the cage and the balance in the event of the main tight ropes failing; while in some cases safety apparatus is adopted, which arrests and grips the cage tightly in the event of failure or undue stretching of any of the hoisting ropes.

The most likely form of trouble is in connection with the gates, and various designs of collapsible and swinging gates have been produced, in order to avoid accident. Interlocking between the cage and the gate is essential, and may be accomplished either mechanically or electrically. A construction very frequently adopted depends on the grip which is obtained on the hand starting rope. This is adaptable to all hand rope-operated lifts; and as one hand rope can be fixed outside the gate and one in the cage, it is not necessary to reach through the gate to start the lift. The gate is automatically locked across the opening when the cage is away, and it can only be opened by hand to admit of entrance to the cage when the cage is stopped approximately level with the floor. When the cage is stopped on any floor the handle of the rope grip is moved to a horizontal position in front of the collapsed gate, and, at the same time, it grips the starting rope on the inside, preventing the lift from being started from either the inside or outside. When the rope grip is released the gate automatically closes across the opening, and automatically locks. Another useful locking device in connection with rope control may be mentioned. Occasionally a lift is overloaded and refuses to rise when power is applied. Someone steps out to lighten the load, but, before he can get entirely clear, the relieved cage starts away, and a serious accident results. Moreover, the cage may have been properly stopped, but it is operated by the hand-rope method of control; and if any part of the hand rope is accessible from another floor, a person other than the attendant could incautiously start the cage while a passenger was entering or leaving. In order to overcome this trouble, a hinged barrier bar can be coupled to a rope gripper. When the cage is in motion the bar lies across the doorway of the cage and the gripper is free. On stopping the lift, however, no person can enter or leave the cage until the bar is raised out of the way, and this opening of the bar simultaneously closes the grip on the hand rope and locks it in the closed or standing position. It therefore follows that as long as the bar is open the lift cannot be started, and passage into and out of the cage is automatically rendered safe. Moreover, as the bar must be closed to release the hand rope, no person can pass while the power is on, even though it is standing owing to overloading. If the bar is improperly raised while the lift is travelling either up or down the power is automatically cut off and the lift is brought to rest.

An alternative form of interlocking is an electrical one, which is suitable for electric lifts operated either on the push-button control, switch-in-cage control, or hand-rope control. This type of gate is hand-opened and closed, and only with the lifts having the switch-in-cage control is an attendant necessary. Each gate is provided with an electric switch, and all these switches are connected to the controlling apparatus, so that the lift cannot be started until every gate in the lift shaft is closed across the opening when the cage is away, and no gate can be opened until the lift is stopped at a floor. In the locking of automatic lifts, it should be noted that three things have to be done. First of all, the door or gate has to be shut; it should then be latched, and then current has to be given to the machine. In some such locking systems, trouble arose owing to an attempt to make these three things occur simultaneously. If the closing of the gate happened to be completed first the gate was not latched, nor was current given to the machine. That fault was then corrected by allowing the latch to act and the switch to be closed before the gate was completely closed. This is obviously a dangerous procedure, for the gate may be pulled back and an arc drawn out without stopping the machine. If the switch happens to be closed first the machine can start with an unsecured gate, a contingency which has given rise to the largest number of accidents. A lock has, however, been designed for the purpose of performing the three requisite functions in a definite sequence. First, the gate or door must be completely closed; until this is done nothing further can be effected; then follows the latching of the door, and until that is securely done it is impossible to give current to the machine. Finally, the circuit is closed and current is applied. On opening the door the reverse order is equally definite: first, the current is cut off; and then only can the gate be unlatched, and finally opened. In some safety locks a counter-locking action is operated by springs as the cage moves away from the door. Breakage of springs has sometimes rendered the counter-locking inoperative. In recent designs of safety locks this difficulty has also been removed.

Reference may be made to a type of automatic gate lock which has been largely applied to lift purposes. The automatic cage lock consists of a vertical spring plunger fixed in the floor immediately under the doors or gates giving access to the lift. This plunger is withdrawn by a cam fixed on the lift cage operating the lever by a small roller. When the cage leaves the floor level the plunger is forced into the bottom of the doors, and this action securely locks them. Inasmuch as the operating levers are inaccessible from the outside, it is impossible to open the doors unless the cage is at the floor level.

It will probably be objected that, however carefully the means of automatic control and safety provision is designed, there are always to be found persons of sufficient ingenuity to render all provisions for their safety of no use. This is undoubtedly the case, and he would be a bold designer of lift machinery and accessories who would be prepared to say that under all conditions and circumstances his apparatus was absolutely foolproof. At the same time, a great deal has been done to mitigate the possibility of accident due to ordinary carelessness, and in the above description it has been attempted to show as briefly as possible the main features of design, as shown in the work of such firms as Messrs. Rawlinsons, Ltd., of Leeds; Messrs. J. C. Etchells & Co., Ltd., of Manchester; Messrs. Smith, Major and Stevens, Ltd., of Northampton; Messrs. Holt and Willetts, &c. Inasmuch as the reliability of the electric lift is, apart from its undoubted economy of operation, a most potent factor in securing its adoption for commercial purposes, it is considered advisable to point out the means and methods which have been adopted to secure the safety of the public.

CHICAGO LABORATORIES AND CANADIAN TRADE.

Mr. F. A. Cambridge, city electrician of Winnipeg, recently wrote the following interesting letter to the Canadian *Electrical News*, respecting the report of Mr. Hamilton Wickes on the Chicago Underwriters' Laboratories and Canadian Electrical Trade, which was printed in our issue of January 3rd, 1913. He refers to an editorial comment made by our contemporary.

"While you are in the main correct as to the high standard of British manufactured articles, there are still a number of appliances and articles of manufacture of British make that are not in many respects up to the standard of American or Canadian goods intended for similar purposes. I know of what I speak as I have been in this work for the last 18 years and have repeatedly had to refuse to accept British made appliances and material, although this city does not, in spite of the statement of Mr. Wickes, insist upon the Laboratories' label. It seems to me that in this question two points have to be considered, namely; first, the standard of quality and the fitness for the duty and, second, the standardisation of dimensions of certain appliances, such, for instance, as cut-outs or fuses. You will remember the years of effort that were necessary before a simple matter like the standardisation of enclosed fuses was reached and similar action in regard to lamp sockets and lamp bases.

"Mr. Wickes seems to be afraid that under the present arrangements the Laboratories impose no restrictions as to the 'danger to life' factor. It is true that the Underwriters are largely represented on the National Code Committee, but all the other interests are also represented, and during the last few years the question of 'danger to life' has been increasingly emphasised in the Committees' rulings, and there are numerous rulings in the code that not only protect against fire, but also enforce the necessary safeguards for the protection of life, as, for instance, the grounding of the neutrals of the low-tension system. It is rather remarkable that Mr. Wickes should lay stress on this point, as in his own

country the requirements have been extremely lax on this point up to a very recent date, in fact, until recently apparatus and appliances have been sold and used in Great Britain that would not be allowed in this country where a properly organised Inspection Department existed; for instance, a long-skirted Edison base lamp having a live projection of 1½ in. below the socket. Such crude and unsafe methods were eliminated years ago on this side of the water, and inspection departments of this country find this form of lamp to-day (constantly imported from European points) to be one of the most serious menaces they have to deal with

"While the British manufacturers are, no doubt, handicapped by the present conditions, and while as an Englishman myself I am doing everything I can to facilitate the placing of their goods on this market, the whole trouble is due to the fact, to use the words of your editorial, 'The Englishman does not feel the need of the same progressive step until he comes into direct contact with the United States' product in this continent,' and, judging by the increasing number of fatalities in the British Isles, due to electrical causes, it will not be long before public opinion will force the authorities to take a progressive step and call for the standardisation of electrical fittings generally.

"I believe that we should in Canada have a laboratory for testing purposes either under the Government or Underwriters' auspices, whose rulings would be accepted by the American laboratory, we in turn accepting theirs, so that a uniformity of ruling would exist. I understand that there have already been some proposals along this line, and with the institution of such an examining body the British manufacturers would not be under any disadvantage in exporting goods to Canada. I have at times come in contact with some of the leading members of British firms, who have been over here looking up trade possibilities, and in most cases they have expressed their readiness to adapt their goods to Canadian practice; on the other hand, there are Britishers of the well-known stubborn variety who will think that 'what is good enough for John Bull is good enough for Johnny Canuck,' but the latter has a habit of suiting himself. I imagine that a form of British standard that would be recognised the world over, will hardly come about.

"I cannot refrain from expressing my indebtedness to the American laboratories for the excellent work they are doing. It is of the very greatest value to the department over which I preside, in fact I do not know how we could get along without the valuable assistance they render from time to time. We are especially pleased with the way they are handling the rubber-covered wire situation to-day. Canadian manufacturers have found no difficulty in complying with the Laboratories' tests. Canadian manufacturers are to-day turning out wire with the Laboratories' labels, and I was only the other day requested to collect samples of wire found in the field and forward same to Chicago, when they would be tested and reported upon free of charge. The value of this service is, as I have said, very great, and I do not think it is sufficiently appreciated."

LEGAL.

Johnson *v.* Johnson-Billington Electricity Meters, Ltd.

Mr. William Harry Johnson, of Teddington, an engineer, and the inventor of the Johnson-Billington electricity meter, brought an action in the King's Bench Division on April 9th before Mr. Justice Horridge and a common jury, to recover a sum of money, amounting to about £140, which he alleged was due to him as salary by Johnson-Billington Electricity Meters, Ltd.

Mr. Patrick Hastings said the plaintiff was the inventor of the electricity meter which the defendant company was formed to acquire and exploit. The company was formed in 1910, and in August of that year the agreement was entered into under which the present action was brought. The agreement was for a period of five years, and apparently the company could get rid of the plaintiff, but he could not get rid of the company. His salary was £200 for the first year, and £250 a year afterwards. Plaintiff was the largest shareholder in the company, and he worked for them from August to the time this action started. His salary was paid for a certain period, and then stopped.

The other directors of the company were Mr. Billington and Mr. Spiller, and there appeared to have been some difference between them. The company had set up a number of defences. One was that the company, being in want of funds, they suggested that plaintiff should waive his rights until he was successful in raising fresh capital, when the arrears of his salary would be paid. Another defence was that the company had said they would not pay, and that that put an end to the agreement, and that he accepted and adopted this because he did not issue a writ at once. A third defence was that the plaintiff voted against an increase of capital, and thereby prevented the arrears being paid, and a fourth defence was that the plaintiff was not entitled to arrears because he had been negligent in not telling the company that the Beck Flame Lamp Co., which company was under contract to make all the mechanical parts of the Johnson meter, was insolvent, and that by not informing defendants of that fact they lost possession of moneys in the possession of the Beck Flame Co., which were the property of the defendant company. Counsel said, as a matter of fact, the plaintiff had nothing to do with the financial aspect of his company's dealings with the Beck Flame Co., and that further, the directors of the defendant company and the Beck Co. being the same, the defendants knew as much about the affairs of the Beck Co. as plaintiff did.

Plaintiff, in the witness box, bore out the opening statement of counsel.

On April 10th, Mr. Saunderson, opening the case for the defence, said Mr. Johnson had nothing to complain of, as he had 2,000 shares in the company, while Mr. Spiller and his friends had to find the capital. It was the plaintiff himself who had brought disaster on the company by refusing to agree to the raising of further capital.

Mr. Spiller, a director of the defendant company, and one of the original promoters, said he told Mr. Johnson he must not rely on his agreement, but he (witness) would do all he could for him, and that, if they could find more capital, he would do all he could to pay him. Witness said that his grievance was that the plaintiff did not tell the Meter Co. about the insolvent condition of the Beck Co. At the time of the liquidation of that company, witness wanted to buy it, but it was acquired by a Mr. Davis. Witness went to Davis, and asked him to continue to make the meters for the Meter Co. and to give Johnson employment

After further evidence, and the counsel and Judge had summed up, the jury, without retiring, returned a verdict for the plaintiff for the agreed sum—£131, plus £12 10s.

His Lordship entered judgment for the plaintiff for this amount, with costs.

Relighting of Electric Lamps in Mines.

At Chester-le-Street (Co. Durham) Police Court, on the 9th inst., Robert Smith, 16 years old, a driver, was summoned for an offence against the Electric Lighting Regulations for Coal Mines at Handon Hold "Busty" Pit, on March 7th. The accused pleaded guilty. Mr. J. Turnbull, who prosecuted, said that statutory regulations had been made for controlling the relighting of electric lamps in mines, and the apparatus for relighting them was kept in a locked box down the mine, and only officials were supplied with keys, or were entitled to open the box or relight the lamps. The defendant was found in possession of a contrivance by which he was able to open the box. It was an exceedingly simple thing, and the owners had been shocked to find that the apparatus was so easily opened, and they had made an arrangement with the manufacturers to have a patent lock put on.

Thomas Whitaker, a driver, said he saw the defendant open the relighting apparatus with a nail. He put in an electric lamp to have it relighted, but the under manager arrived, and the operation was not completed.

A fine of 10s. and costs was imposed.

Birkenhead Tramcar Contracts: Slander Action.

At the Liverpool Assizes, Mr. Justice Bankes heard an action to recover damages for alleged slander, in which the plaintiffs were Messrs. G. C. Milnes, Voss & Co., Ltd., railway carriage and tramcar builders, of Birkenhead, and Thomas Voss, and the defendant Councillor E. T. Coston, J.P., chairman of the Tramways Committee of the Birkenhead Corporation.

Mr. Rigby Swift, K.C., M.P., and Mr. William Proctor appeared for the plaintiffs, and Mr. F. A. Greer, K.C., and Mr. A. Kennedy represented the defendant.

Mr. Rigby Swift, in opening the case, said the action had been brought against Mr. Towler Coston in respect of a series of defamatory attacks he had made upon the plaintiff company and upon Mr. Voss at a meeting of the Birkenhead Town Council on July 10th last in regard to certain tenders for new tramcars making allegations of a most serious character against the plaintiffs. He had alleged that they were incompetent in their work; suggested that their financial position was not sound; that they were not able to carry a sufficient amount of stock for their business, and that they were living from hand to mouth. He said that they (plaintiffs) had improperly obtained knowledge of rival contractors' tenders, and he charged them with using underhand and discreditable means in order to get their own tenders accepted. Defendant, counsel added, did not now suggest that any of these allegation were true. What he said was that he had not used the words complained of, that his statement could not be said to have the meaning now put upon it, also that he made the remarks upon a privileged occasion, and was making comments upon a matter which was o important public interest. Counsel added that public men should not be allowed to take advantage of their position and a privileged occasion to say things about other persons for which there was no foundation. The speech was not fair comment, but rather a malicious statement of facts. Mr. Coston, in his desire to ge Messrs. Hurst Nelson's tender accepted for the supply of new tram cars, had made charges suggesting that the plaintiffs, or one of them, had been guilty of conducting their business by improper and dishonourable methods; that they had attempted to persuade, and did persuade, a member of the Committee to use his position for his own personal gain; that, as manufacturers, they were incompetent and unable to execute any large orders; that the plaintiff company were a firm of a precarious financial stability, and consequently unable to keep a sufficient supply of timber in stock. The plaintiffs had brought this action in order to show that Mr. Coston's charges were unfounded.

Thomas Voss, in giving evidence, said he had never at any time received a complaint about the cars he had converted for the Cor-

poration that he not remedied. Dealing with the complaint about leaky roofs, he stated that the cars were made to carry 64 passengers each, and he now knew that as many as 130 had been carried. He could quite understand why trusses and bolsters were required, in view of the overcrowding. He was asked in January, 1910, to send in new tenders, and later heard that those of another firm had been accepted. Whilst being invited to tender, there was never any suggestion that the work he did in 1909 was bad work. In regard to his transactions in connection with the tenders, he did nothing that was either unbusinesslike or disgraceful tactics. There was no foundation for the suggestion that Mr. Dickie, timber merchant, advocated plaintiff's contract in order that he might get something out of it himself.

By Mr. Greer: Plaintiff said he had between January, 1909, and July, 1912, distributed orders in Birkenhead amounting in value to over £5,262. He had never discussed with Mr. Dickie the position of plaintiffs' tenders and the efforts he (Mr. Dickie) might make to get local tenders accepted.

Councillor Dickie, a member of the Birkenhead Tramway Committee, emphatically denied that he had given information to Mr. Voss of what was going on in the Committee. He had committed no breach of conduct as a councillor.

Mr. Greer: Was it discreet in your opinion to take part in the discussions when you knew that if Mr. Voss's tender was accepted you would make money out of it through supplying that firm with timber?—It was not until I had consulted my solicitor in regard to the allegations that I knew that I could have supplied the timber.

Mr. Greer: At the committee meeting on June 26th, Mr. Coston said "Mr. Dickie has conveyed to Voss the business that has been transacted in this Committee." How is it that you did not contradict him at that meeting?—I believe that I did.

Councillor W. M. Furnival, another member of the Tramways Committee, said there was no ground for the suggestion that he had improperly supplied Mr. Voss with information as to what took place at the Committee meeting.

For the defence, Mr. Greer said there could be no doubt that the question of these tenders for new tramcars was a matter of great importance and interest to the members of Birkenhead Town Council, and to the ratepayers generally. If Mr. Coston, believing what he did in reference to the work done by Messrs. Milnes, Voss and Co., had not drawn attention to the matter, he would have been failing to perform his duty as a councillor. The report of the tramways manager in respect to the tramcars which had been altered and refitted by Messrs. Milnes, Voss & Co., contained a series of complaints that could not have been made if the work had been adequately and properly done. Mr. Coston could not but believe the manager's report, and in doing so he could not come to any other conclusion than that this was a disgraceful piece of work. There was nothing in Mr. Coston's speech that could be construed as an attack on the financial stability of the plaintiffs' firm. Referring to the tenders, Mr. Greer said it had been shown that plaintiffs had reduced their estimate when none of the other contractors had been invited to do so, and the defendant thought that information was being passed to the firm from the Committee. Under those circumstances, he was of opinion that he would have been lacking in his public duties if he had not expressed his views.

Mr. Coston, in his evidence, said that when he heard the tramway manager's report read in the committee he was astounded. It was the first time that he had heard of any serious complaints in regard to these tramcars. Mr. Furnival at that meeting described the report as prejudiced and ridiculous, and that led him (witness) to visit the depôt, and after seeing the superintendent's reports and books relating to the matter, he came to the conclusion that the report was accurate. Assuming the report true, it was his candid opinion that it was the most disgraceful piece of workmanship that could be turned out.

By Mr. Swift: He knew that Voss's for 12 months had to keep these cars maintained, and that with the exception of the superintendent's report of July, 1910, and November, 1911, there was not a solitary complaint after the 12 months had expired. He knew that the cars had been subjected to a very great strain. He did not make any inquiry as to whether the charges against Messrs. Voss were true or not. He was convinced they were true. He did not want the Council to believe that the firm were incompetent, but that they had done bad work. Witness admitted that the plaintiffs had been invited to reduce their tender.

At the conclusion of defendant's evidence, Mr. Greer informed the Court that the defendant was now satisfied, after the investigation that had taken place, that upon the real facts of the case there was nothing which entitled him to say that there was anything discreditable in relation to Messrs. Milnes, Voss & Co.'s business transactions, and he did not now allege that there was any disgraceful work done by them. Mr. Coston therefore withdrew the charges, expressed his regret, and agreed to pay costs as between solicitors and clients.

Mr. Rigby Swift said that there was never, from the very first, any desire on the part of the plaintiffs to make any money out of the allegations made against them. What they desired was that the charges should be withdrawn in the fullest and most public manner, and that it should be made plain to everybody that there was no foundation for them.

Mr. Justice Bankes thought that Mr. Coston had taken the right course. He felt considerable sympathy with Mr. Coston, because he believed that the report from the tramway authorities had been most misleading. While he (the Judge) was sitting there he would honestly maintain the right of a member of a properly constituted authority to speak boldly and fearlessly when he honestly believed that there was something going on which was wrong. It was because of the false impression created by the report that Mr. Coston had been led to suggest things which he had no right to suggest. The investigation had made it quite plain that Mr. Coston had gone too far—further than the occasion really allowed—and it was now only right that Messrs. Milnes, Voss and Co. should be absolved from those charges.

Osram Lamp Litigation.

Mr. Justice Swinfen Eady, on Friday, April 11th, in the Chancery Division, had again before him the motion of the Osram Lamp Works, Ltd., *v.* the Yorkshire Incandescent Electric Co., but, with his Lordship's consent, the matter stood over for another week, in order that the evidence might be completed.

In Mr. Justice Eve's court on the same day an application by the Osram Lamp Works, Ltd., that a motion against the Electrical Manufacturing Co. to restrain infringement should stand over for a week, was also granted.

Harris *v.* London United Tramways, Ltd.

Before Mr. Justice Bailhache, sitting in the King's Bench Division, with a common jury, on April 9th, Mrs. Esther Harris, a widow, sued the London United Tramways, Ltd., under Lord Campbell's Act, for damages in respect of the death of her husband, who was thrown from his bicycle while riding in the Victoria Road, Surbiton, and killed by a passing motor-omnibus. The accident was caused through the wheel of the bicycle catching in one of the tramway grooves at switch points near Surbiton Station. It was alleged that the defendants were negligent in allowing their line to be in a state dangerous to general traffic. The negligence alleged was that the grooves of the line at the switch points, either from wear or other causes, were too wide, and that the bicycle dropped its front wheel dead into the groove in consequence. Evidence was called to shown that the groove at the spot where the tragedy occurred was sufficiently wide to allow a bicycle wheel to drop in, and before the plaintiff's expert evidence on that point had closed, a brief consultation took place between counsel, resulting in the announcement that there would be judgment for the plaintiff by consent, on terms agreed, which it was not thought desirable to mention publicly. Mr. Geo. Elliott, K.C., appearing for the plaintiff, mentioned that the case was one of great interest quite apart from the individual circumstances, for which reason it had been taken up by the Cyclists' Touring Club.

British Westinghouse Electric Co. *v.* The Electric Palaces Co.

This action came before the Divisional Court of King's Bench, composed of Mr. Justice Channell and Mr. Justice Coleridge, on Monday, April 14th, on an appeal by the defendants from a judgment of the Judge of the Salford County Court.

The action was one which concerned the supply of an engine and dynamo, &c., by the British Westinghouse Co. for an electric theatre in Northumberland, and a counterclaim was set up by the defendants, based upon an allegation of delay in delivery.

Mr. Powell, K.C., who appeared in support of the appeal, stated that after negotiations with a Mr. Worley, the British Westinghouse gave an estimate for the supply of an engine and apparatus for working a picture exhibition, the price being £131 10s., which they said they could dispatch complete within a few days from the receipt of the order. They guaranteed the whole of the equipment for 12 months, and offered to accept deferred payments if 5 per cent. were added to the contract price. Mr. Worley, as agent of the Electric Palaces Co., said that the tender would be accepted, subject to the gas supply from the local gas company being sufficient to enable them to get the requisite power. A correspondence followed, and the letters which passed, together with certain verbal statements it was said constituted the contract. The County Court Judge at the hearing believed the witnesses called on behalf of the Westinghouse Co. in regard to the terms of delivery, which was that the delivery was contingent upon the engine being in stock. There seemed to have been delay in giving the final order, with the result that when it was given the gas engine which they had in stock had been sold. It was then arranged that the engine should be supplied, according to the defendants, within six weeks, but, as a matter of fact, it was not delivered until eight weeks afterwards.

Mr. Justice Channell: On what grounds do you appeal?

Mr. Powell, K.C., said that he appealed on the ground that there was no evidence to support the Judge's finding, that the contract was really made with the Palaces Co., and that the Westinghouse Co., or their representatives, had no knowledge of Mr. Worley's financial position. The terms of the contract were that the engine should be supplied within six weeks "or thereabouts," and "thereabouts" could not possibly mean eight weeks. The claim was only for £11 odd for one instalment. Having regard to all the circumstances of the case, he contended that the judgment of the County Court Judge was unsatisfactory, and submitted that there ought to be a new trial. The delivery in eight weeks instead of six weeks did not satisfy the terms of the contract.

Mr. Justice Coleridge said that the words were "six weeks or thereabouts," and the extra two weeks could not be said to be a matter of law. It was simply a matter of fact.

Mr. Atkinson, for the plaintiffs, said it was a question of what the words meant as applied to particular facts. He argued that

the six weeks did not begin to run until the plans and documents had been furnished by the defendants. The plans were not furnished until September 21st, although the order was given on 15th, and the engine was, in fact, delivered within six weeks and one day from the time the plans were received.

MR. JUSTICE CHANNELL, in giving judgment, said that, upon the assumption that the contract was between the Westinghouse Co. and the Electric Palaces Co., the question was, what were the real terms of the contract as to delivery? If the first tender had been accepted straight off, it would have been a question of the construction of that tender and a question of law. But that was not the case. There were interviews and alterations in the contract which gave the Westinghouse Co. reasonable time in case they had not the engine in stock. The County Court Judge thought that the evidence of those who spoke to the six weeks was so satisfactory that he could disregard what was in the correspondence, and that was entirely a question of fact. The delivery was only one day out, and therefore it was treated at the trial as being within the contract time. That being so, there was no ground upon which the Court could set aside the judgment, and the appeal must therefore be dismissed.

MR. JUSTICE COLERIDGE agreed, observing that the contract being partly verbal and partly in writing, it was for the judge to decide whether what was said in writing was only part of the contract. It was entirely a question of fact, and the Court could not interfere.

The appeal was accordingly dismissed with costs.

THE POULSEN PATENTS.

IN the Chancery Division on April 15th, Mr. Justice Warrington had before him a petition in the matter of Valdemar Poulsen, No. 8,961, of 1899, and in the matter of the Patents and Designs Act, 1907. The petition was put into the paper to be mentioned.

MR. BYRNE, for the petitioners, said that it was an application in a case in which a petition was being presented for the extension of the term of certain patents granted to Valdemar Poulsen. The rules under the Act gave the Court an absolute discretion to deal with the matter as should be thought fit. In the present case time for alleging notice of opposition had long since expired, and no notice of opposition had been given. The Board of Trade was the only party interested, and the petitioners had given them notice. Mr. Austen-Cartmell, who had appeared for the Board of Trade, had intimated to him (counsel) that the Board did not propose to offer any objection.

The facts were that Valdemar Poulsen was the inventor of the patent, and the present petitioners were an American company incorporated in Maine, U.S.A., who were the assignees of the rights. A large portion of the shares were held by a Danish company. The purpose of the amendments was to set forth in greater detail the whole history of the foreign dealings with certain patents. They had nothing to do with what had been done with the English patents. In the course of preparing the preliminary proceedings, certain further information had come to the petitioners' advisers in England, which they felt it was their duty to lay before the Court and the Board of Trade. They were now seeking to insert that information, and the reason that information was not obtained earlier was because all the matters had to be dealt with by correspondence with the United States and Denmark. Certain very complicated transactions were carried out in 1905 and 1906 between a certain Stilson Hutchins and one Lindafoord, who represented the Danish interests. Mr. Hutchins became quite unable to transact business, and then died, and Mr. Lindafoord died on his way to America. No proper record in writing had been kept of the greater part of those transactions and negotiations. When the advisers of the petitioners were preparing their accounts for lodging, a difficulty arose as to getting some of the books from abroad, but eventually it was arranged that a book-keeper should bring the books from America. Lord Parker (then Mr. Justice Parker) then gave an extension of time for lodging those accounts. In the course of going through the accounts the petitioners' advisers in this country first became aware of the extremely complicated nature of the transactions in connection with the foreign patents. The information asked for by the petitioners' advisers was only obtained in part from the United States on April 7th, and two days later a copy of the petition was informally submitted to the Board of Trade for their information, so that there had been no delay so far as anyone on this side was concerned.

The original petition stated that the company was formed in 1899, for the purpose of exploiting the patents, and gave the history of the subsequent dealings, so far as they were known to petitioners. It was believed that the transactions with the American and Canadian patents were of a very simple character, but, of course, that was now known not to be the case.

MR. JUSTICE WARRINGTON: It seems to be a statement of fact by the petitioners, which it may be material to consider.

MR. AUSTEN-CARTMELL: Yes. The view I take on behalf of the Board of Trade is that the general rule is that the Board of Trade would oppose. Here, there is no notice of opposition from any member of the public, and the only party appearing except the petitioners would be the Crown. There is also the point to be taken into consideration that the greatest possible difficulties had been experienced by the legal advisers of the petitioners in this country in obtaining information. We have been informed by the solicitors for the petitioners, in whom we have every confidence that every step has been taken to expedite matters. Under those circumstances I am prepared to leave the matter in the hands of the Court, but it must not be taken as a precedent, but simply because of the special circumstances of the present case. If the Court allows the amendments, a day had better be fixed for the petition to come into the list to fix a day for the hearing. I suggest the 24th inst., as the patent expires on the 28th inst.

HIS LORDSHIP: I think I ought to allow the amendment under the circumstances, and I appoint the 24th inst. as the appointed day. This is a very special amendment.

MR. BYRNE: It does not affect any party.

MR. AUSTEN CARTMELL: It is true that no notice of objection has been given, but the Court has power to allow anyone to come in.

HIS LORDSHIP: I think the petitioner had better give notice in the *London Gazette* of the appointment of the 24th inst. as the appointed day on which the amended petition is to be in the list.

NATIONAL TELEPHONE ARBITRATION APPEAL.

THE cross appeals in the National Telephone Arbitration from the decision of the Railway and Canal Commissioners on the arbitration with regard to the taking over of the National Telephone Co.'s undertaking by the Post Office, came before the Master of the Rolls and Lords Justices Buckley and Kennedy on Tuesday, April 15th.

The notice of appeal given on behalf of the Postmaster-General asked that so much of the judgment of the Court of the Railway and Canal Commission as decided that, in determining the value as on December 31st, 1911, of the plant of the company purchased by the Postmaster-General, the Court might take into consideration—

(*a*) The cost of raising a sufficient amount of capital to pay for the construction of the company's plant.

(*b*) Any part of the cost of the company of inducing persons to agree with the company for the supply to them of a telephonic service and for installation upon their premises of telephonic plant for the purpose of supplying such service,

might be reversed, and that it might be declared that neither of the said matters might be taken into consideration in determining the said value, and that the amount of £10,459,796, ascertained as the depreciated value of the said plant, might be reduced by the sums allowed by the Court being in respect of (*a*) the sum of £249,189 and in respect of (*b*) the sum of £150,000.

The cross notice of the Telephone Co. stated that, upon the hearing of the Postmaster-General's appeal from the order and determination of the Court of the Railway and Canal Commission, the company intended to contend (if and so far as an appeal was open to the respondents) that the order of the Court of the Railway and Canal Commission should be varied, and that the amount should be increased to such amount as the Court should seem fit, and that the order and determination might be remitted to the Court below (if need be), with proper directions for arriving at the amount of such increase and all other necessary or expedient directions. In particular, the respondents would contend that the said amount was insufficient on the following grounds:—

1. There was no evidence or legal ground to justify the Court in reducing or excluding from consideration the sums, or any of them, estimated by the respondents as items of cost over and above the "agreed fundamental cost," which would be incurred in constructing and establishing the plant.

2. The method of depreciation adopted by the Court was wrong in law, and/or there was no evidence on which to found its correctness, nor of disallowing the respondents' basis of arriving at this allowance.

3. That an allowance should have been made by the Court by way of an additional sum given in respondents' favour, in view of the fact that substantially the whole of the said plant was suitable for the purpose of the Postmaster-General's telephonic service, and/or was complete, and ready *in situ*, for working and use on December 31st, 1911.

4. That the Court were wrong in their disposal of, and method of dealing with, the respondents' respective claims under the headings of "head office engineering," "contractors' profits," "contingencies," and "separate establishment."

5. That the Court mistook in some of their calculations the meaning of "value."

On the appeals being opened by the Attorney-General for the Postmaster-General, Mr. Danckwerts, for the Telephone Co., took the preliminary objection that no appeal by the Postmaster-General would lie. On this point, after hearing the Attorney-General and the Solicitor-General, their Lordships reserved judgment until the following day.

The Master of the Rolls and Lord Justice Kennedy (Lord Justice Buckley dissenting) then held that the preliminary objection failed, and by agreement between counsel for the respective parties, and with the consent of their Lordships, it was arranged that, pending an appeal by the Telephone Co. to the House of Lords from the decision of their Lordships upon the preliminary objection, the hearing of the main appeals should stand over.

The Attorney-General stated that he would endeavour to get the House of Lords to hear the appeal in question as soon as possible.

PROSECUTION UNDER THE FACTORY ACTS.

"AS a result of the electricity regulations not being complied with, Thomas James Brownell met his death through a connector socket not being protected," remarked MR. H. H. C. THOMAS (H.M. Inspector of Factories) in prosecuting the Patent Shaft and Axletree Co., Ltd., Wednesbury, on Tuesday in last week, at the local Police Court. The prosecution was under the Factory and Workshop Act, 1901 and 1907, Sec. 136.

The Hon. R. W. Coventry defended, and Mr. F. A. Platt (Walsall) appeared for Henry Bates (25), who had been summoned under the same Act.

The connector socket, MR. THOMAS explained, was on a wooden horizontal bar near to a drilling machine where Brownell worked.

It was 3 ft. 6 in. from the ground, and 12 in. from the machine. At the time of the accident the socket was connected up and charged with current, which had a voltage of 205 alternating. Some time before the accident there had been a cover on the socket, but this had not been so for a fortnight previously. At the spot the ground was wet, with the result that practically the whole of the voltage would be applied to the man's body. Although a cover had been off the socket for a fortnight, no attempt had been made to replace it.

The evidence called for the defence was to the effect that it was an unwritten law that the men should report breakages. From 20 to 30 of them were reported every day. Men were continuously doing repairs about the works, but this particular plug might not have been seen.

The Stipendiary Magistrate decided that there had been no negligence by the firm, and dismissed the case.

The summons against Bates was withdrawn.

PARLIAMENTARY.

Southport Corporation Bill.

Mr. Middlebrook's Select Committee of the House of Commons commenced the consideration of this Bill on April 8th. The Bill is an Omnibus Bill dealing with a number of proposals affecting the government of the borough, but one of the principal objects is the obtaining of authority to run trolley vehicles and omnibuses. Mr. H. Lloyd, K.C., and Mr. Jeeves appeared for the promoters, and a large number of opponents were represented by counsel.

Mr. Lloyd, K.C., in his opening address, said that under a series of orders and an Act of Parliament, a system of tramways had been constructed in the borough which was worked partly by the Corporation and partly by their lessees, the Southport District Tramways Co. In 1900 the Corporation obtained powers to construct a new line along the Promenade; but as they thought on further consideration that the traffic would not be remunerative the powers were allowed to lapse. It had always been considered desirable to give the public further facilities along the route, and it was felt that a system of trackless trolley-cars would give these facilities. The cost of the equipment of the scheme was estimated to be £3,500, with £2,250 for the vehicles. The chief opponents were the Victoria Pier and Promenade Hotel Co., who submitted that the trolley-cars would injure the hotel; the Lancashire and Yorkshire Railway Co., who contended, amongst other things, that the carriage of goods on the tramway would be injurious to the district; and the Cheshire Lines Committee, who opposed on the ground of competition. The Southport Tramways Co. and the Birkdale Electric Supply Co. had also presented petitions against the Bill.

Mr. J. B. Hamilton, general manager of the Leeds Corporation Tramways, gave evidence to the effect that he had carefully examined the proposed route, and considered it suitable for a trackless trolley system. He looked on the route as one upon which people would ride to and fro for a constitutional. He estimated a gross revenue of 10d. per mile, and that there would be a net surplus of £189 per annum.

In cross-examination by Mr. Ram, K.C. (representing the Johnson Trustees), witness said the trolley-cars created much less dust than motor-cars. It had not been decided whether the cars would be single or double-decked.

In answer to Mr. Forbes Lankester, witness said it was proposed to take powers for carrying goods and minerals on the trolley cars. It was true that in the cases of Bradford and Keighley there was a prohibition in this respect.

After some discussion, Mr. Jeeves intimated that his clients would agree to a prohibition of the carriage of parcels beyond 56 lb. in weight.

Witness was cross-examined at length by Mr. Forbes Lankester for the Victoria Pier and Hotel Co. on the point that in a seaside town of the character of Southport it was better to keep the Front free from tramway or trolley, and, in reply, he said that while this was a matter of high policy with which he could not deal, yet from his point of view he thought this was a road on which the poor man's car should be allowed as well as the rich man's.

Alderman T. P. Griffiths (chairman of the Parliamentary Committee of the Southport Corporation) gave evidence in support of the scheme, and said the trolley cars would add another to Southport's many attractions.

Mr. R. P. Hirst, consulting engineer to the Corporation, considered there would be no fear of vibration from the running of the trolleys along the Promenade.

Other local evidence was called in support of the Bill.

Mr. Forbes Lankester, on behalf of the Cheshire Lines Committee, said that having arrived at the limit of 56 lb. for parcels, he would not trouble the Committee further with regard to the trackless trolley proposals.

Mr. Vesey Knox, K.C. (Lancashire and Yorkshire Railway Co.), said the particular route would not affect his clients' interests, but they wanted safeguards introduced having regard to Sec. 31 of the Bill, under which it was proposed to apply to the Board of Trade for prov. orders for new routes. He asked that notices of intention to apply for such prov. orders should be inserted in the *Gazette*, as well as in the local papers.

A large number of witnesses then gave evidence to the effect that the trolley cars would affect property detrimentally.

The Committee decided to approve the scheme, and inserted clauses for the protection of the property of the Cheshire Lines Committee.

On April 15th, having heard the opposition of licensed vehicle owners, the Committee rejected the motor-omnibus proposals.

Metropolitan Railway Bill.

On April 10th a Select Committee of the House of Lords, presided over by Lord Sanderson, commenced the consideration of this Bill for purchasing the Great Northern and City Railway, and for making two extensions of that line.

Mr. Lloyd, K.C., in opening the case for the promoters, said the Bill was an omnibus one containing a number of provisions, many of which were not opposed. The main features of the Bill were, first, to sanction the vesting in the Metropolitan Railway Co. of the undertaking of the Great Northern and City Railway Co.; and secondly, to authorise the Metropolitan Railway Co. to construct certain new railways as an extension of the Great Northern and City line. The Bill also asked for powers to enable the Metropolitan Co. to enter into agreement with the London and South-Western Railway Co. for the construction and working of one of the extensions, and for the working of through traffic. The first part of the Bill, which was unopposed, was that which sought to vest in the Metropolitan Co. the existing undertaking of the Great Northern and City Co. That was an electrically-worked tube railway of about 3½ miles in length extending from Finsbury Park to Moorgate Street. It was recognised shortly after the line was opened that if it was to serve a really useful purpose, and was likely to be remunerative, it must be carried on beyond Moorgate Street, where it now stopped, and in 1902 the company obtained powers to extend the line from Moorgate Street to Lothbury. Unfortunately the company had never been able to find the money to construct the extension, and the powers had lapsed. The result had been very unfortunate to the Great Northern and City Co., for they had found themselves in a financial position which had prevented them doing that for the public which they desired to do. The line had no connection with any other railway, and the company had not been able to pay its fixed charges, and it could not go on in its present hands. That position had been fully realised by the directors and stock holders of the company, and they had been approached from time to time by many other companies who were interested in their traffic, and after considerable negotiations the Metropolitan Co. had succeeded in arranging terms by which the Great Northern and City Co. was to cease to exist as a separate entity, and was to become amalgamated with the Metropolitan. The result was the promotion of the present Bill. Originally there were four extensions proposed, but two had been struck out. The two proposals that remained in the Bill were first for extending the Great Northern and City line from Moorgate Street to Lothbury, which was practically a re-enactment of the line which was authorised in 1902, and the second proposal was to form a junction with the Waterloo and City Railway at the Bank Station. The result of the construction of these two extensions would be to enable the Great Northern and City line to be carried to the point where Parliament intended it should be carried so long ago as 1902, and it would also bring people from the North of London into direct communication with the London and South-Western Railway. The estimated cost of the first extension was £256,540, and of the second £53,749.

Having proceeded to detail to the Committee the manner in which it was proposed to construct the proposed extensions, counsel dealt with the opposition, which chiefly came from the City Coporation, the Bank of England, the Grocers' Company, the Gresham Assurance Co., and the Northern Assurance Co. He said that the objections of the City Corporation were against interference with streets in the heart of the City and depreciation of property which might result. Those objections could easily be met, and in view of the great public advantage of the scheme, he felt sure that the City authorities were not really antagonistic to the proposals. Dealing with the allegations of other petitioners that damage might be caused to their property from the excavation of the subsoil and the pumping out of water, Mr. Lloyd said they were the same objections as were brought forward in 1902, when Parliament approved the scheme.

Mr. Ram, K.C., who appeared for the Bank of England, said that while the Governors and directors of that institution had no desire to oppose a scheme which might be for the public advantage, they felt that the Bank should be granted the fullest possible protection.

Mr. R. H. Selbie, general manager of the Metropolitan Railway, having given evidence in favour of the scheme, the Committee adjourned.

(*To be continued.*)

London County Council Tramways.—The House of Lords' Standing Orders Committee have decided that the Standing Orders not complied with in respect of the London County Council Tramways, Trolley Vehicles and Improvements Bill shall be dispensed with, subject to the omission therefrom of tramways 2, 4, 4A, 5, 5A, 6, 8, 8A and 8B, and to the consent of the Hampstead Borough Council in respect of tramway 3A being proved before the Committee on the Bill. The proposals which are, therefore, to be struck

out of the Bill are the following: A double line between the county boundary in Finchley Road and the existing tramways in Chalk Farm Road, *viâ* Finchley Road, Avenue Road, Adelaide Road and Chalk Farm Road; a single loop line from Fonthill Road, *viâ* Evershot Road, Hanley Road, Regina Road and Tollington Park into Fonthill Road again, and then a double line along Fonthill Road to the existing tramways in the Seven Sisters Road; a double line from the existing tramways in Gray's Inn Road to Farringdon Road, *viâ* Holborn and Charterhouse Street; a double line from Farringdon Road to Ludgate Circus; and the tramway in connection with the proposed new St. Paul's Bridge.

Ely Valley Gas and Electricity Bill.—The Standing Orders Committee of the House of Lords have decided that the Standing Orders not complied with in respect of the above Bill, ought not to be dispensed with, and accordingly the Bill will not proceed. The proposal was to incorporate a company with a capital of £45,000 to supply gas and electricity.

Hove Corporation Bill.—The Chairman of Committees reports that the opposition to the Hove Corporation Bill has been withdrawn. The Bill contains clauses for the purchase of the electric light undertaking.

Leeds Corporation Bill.—The Standing Orders Committee of the House of Lords considered this Bill on April 10th, when the Parliamentary Agent stated that the tramway in regard to which there had been a non-compliance with the Standing Orders, had been struck out. Under these circumstances, it was decided to allow the Bill to proceed.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

The Oldham "Emergency" Electric Lamp.

The Oldham "Emergency" electric lamp, which was recently approved by the Home Office for use in coal mines, is of the bull's-eye type, as shown in fig. 1.

The case is of cast aluminium, with a cover secured by a lead rivet lock. The electrical accumulator is so constructed as to prevent escape of the liquid, whatever the position of the lamp, whilst allowing the escape of gas generated by chemical action in the accumulator. A flame-tight screwed plug of vulcanite encloses the contact made between the insulated lead and the positive

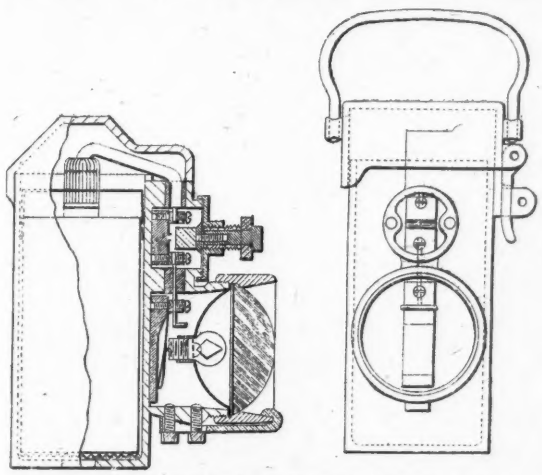

Fig. 1.—The Oldham "Emergency" Miner's Lamp.

terminal of the cell. The switch is contained in a flame-tight enclosure, the cover of which, with its washer, is secured by screws. The screw-heads are pierced so that a wire may be threaded through, and the ends sealed with lead seals. The lamp bulb and reflector are contained in a second enclosure, which communicates with the switch enclosure. It is made flame-tight by means of a screwed ring containing the lens, and a washer. The ring is prevented from unscrewing by means of a clip secured by screws, the heads of which are pierced as in the case of the switch cover screws. The total weight of the lamp is not more than 4 lb. 8 oz., and it is capable of maintaining a light of 1·5 c.p. throughout a period of not less than 10 hours. The lamp is only to be used for work of rescue or exploration in the case of an accident or other emergency, or by officials, and is made by Messrs. Oldham and Son, Denton, near Manchester.

Cinema Theatre Dimmers.

The Adams Manufacturing Co., Ltd., of Balfour House, Finsbury Pavement, E.C., have brought out the "Adams Igranic" cinema theatre dimmers, to enable changes of illumination from dark to light to be gradual and painless; they can be so arranged that the same movement that gradually dims the white lights will also gradually brighten the reds, and so on, and can be mounted in the operator's room with practically no alteration of the wiring. Each dimmer consists of a resistance plate having a large number of contacts and an operating handle, so that the resistance in the lighting circuit can be increased or reduced to lower or brighten the lights. The dimmer plates are standardised and so arranged that a number can be mounted together to deal with separate circuits. They are suitable for any lighting voltage, A.C. or D.C. Each dimmer is specially arranged with an "off" position, so that the lights may be left fully on or fully off indefinitely.

A New Lampholder.

Messrs. John Dugdill & Co., of Failsworth, are placing on the market a "high-duty lampholder," which has been provisionally protected, and in which "an arch or loop of springy metal" is used supplementary to, or in substitution for, the ordinary spring plunger contact stud.

In one of the samples submitted, two strips of ribbon metal are looped round the two plungers, being fastened by the holding-in screws under the latter and bent round so as to pass over the tips of the plungers. The connection between the housing and the end of the stud is thus continuous metal, not through a sliding contact; when pressure is applied, as during insertion of the lamp, it is claimed that the springy loop flattens and accommodates itself to the surfaces of the segments, ensuring a broad contact area, instead of the comparatively small contact area of the present type of plunger.

Another sample sent has a conical spiral spring of ribbon metal looped round the plunger stud and rigidly connected at its base; the end turns make contact with the lamp cap, supplementing the ordinary plunger contacts and giving, it is claimed, increased current-carrying capacity.

Messrs. Dugdill claim that these lampholders are suitable connectors for radiators, small motors, &c.

BUSINESS NOTES.

"Plexsim."—Messrs. Simplex Conduits, Ltd., have registered the above word for use in connection with their electric heating and cooking system, the increasing importance of this department of their business rendering it advisable to give these manufactures a descriptive mark differentiating them from "Simplex" lines such as conduits and fittings. In future, therefore, all their heating and cooking appliances will be labelled "Plexsim."

Reversible Oil Engine.—Messrs. Boving & Co., Ltd., of 9½, Union Court, Old Broad Street, E.C., inform us that they are now running a 16-H.P. marine "Avance" crude oil engine, with special reversible propeller equipment, on load at Southampton. Similar exhibitions will be held at various leading seaports in this country.

Cable Works in Austria.—The Hungarian Felten and Guilleaume Co., of Buda-Pesth, records net profits of £32,500 for 1912, as contrasted with £29,600 in the preceding year, and the dividend is at the rate of 17½ per cent., as against 16½ per cent. in 1911. A considerable number of orders was incompleted at the end of 1912, and notwithstanding the unfavourable circumstances affecting the political horizon and the money market, the company's degree of employment is said to be very satisfactory at the present time.

The report of Felten & Guilleaume, of Vienna, states that the company was abundantly employed during 1912. It was not easy to predict the prospects for the new year, owing to the uncertain political situation and the monetary stringency, which caused customers to exercise reserve in the allocation of orders. Nevertheless, a considerable stock of orders had been brought over into 1913, and the degree of activity was good. The net profits earned in 1912, after placing £18,000 to depreciation as compared with £17,000 in 1911, amount to £117,000, inclusive of the balance forward, as contrasted with £102,000 in the previous year. It is proposed to pay a dividend of 17½ per cent., as against 16½ per cent. in 1911.

Book Notices.—*The Aviation Pocket-Book for* 1913. By R. Borlase Matthews. London: Crosby Lockwood & Son. Price 3s. 6d. net.—This volume is a sign of the times; aviation (why not "flying"?) is now becoming a common-place, the science an industry, and the industry is being equipped with pocket-books, journals, directories, manuals, catalogues and all the other accessories which mark the firm establishment of a new branch of engineering, including an Act of Parliament. The next phase will doubtless be litigation. At any rate, here is the first pocket-book—the work of a well-known electrical engineer, who has now turned his attention to shipping. There is very little in the book, as in the art, of direct electrical interest; the ignition of the engines and the use of the magnetic compass at present cover this part of the subject, but wireless telegraphy is practically the only possible means of communication with aeroplanes, and will become of increasing importance in this connection. The contents of the book cover, broadly, the whole field of theory and practice, and will undoubtedly prove very useful to the flying man. A list of "Aero Clubs and Societies" reveals the surprising fact that there are more than 100 of these in existence in this country and the oversea Dominions.

The *Wireless World* for April—the first issue of the new magazine which has replaced the *Marconigraph*—comes out with a striking multi-colour cover showing "wireless" spanning the globe in a series of zig-zag flashes, which might with advantage have

been arranged to form a Morse message instead of what appear to be a random succession of o's and s's. An introductory article explains that the magazine is to be "popular," and that the information given in its pages, while worthy of the attention of the scientist, will not be beyond the scope of the general public. A special feature is to be the subject of wireless telegraphy as a factor in National defence; with this in view, a special course of lectures for "wireless amateurs" will appear in each issue. A biographical notice of Commendatore G. Marconi, whose birthday is April 25th, together with a portrait, appropriately forms the opening article. Other interesting items are articles on the Aden-Berbera wireless stations; the new Atlantic sentinel, the *Scotia*, which is to give warning by wireless of the presence of ice; the qualifications and prospects of the wireless engineer; a short story; the scheme for free instruction in wireless telegraphy for Territorials, &c., already outlined in our article on the Marconi School; and numerous other features, the whole forming an issue which reflects great credit on all concerned in its production.

"Examinations in Science and Technology, 1912." London: Wyman & Sons, Ltd. Price 9d.

"Electric Furnaces in the Iron and Steel Industry." By Dipl. Ing. W. Rodenhauser and I. Schoenawa. 1913. London: Chapman & Hall, Ltd. Price 15s. net.

"The Illuminating Engineer." No. 4, Vol. VI. April, 1913. London: Athenæum Press. Price 1s.

"Australian Mineral Statistics." 1913. Melbourne: *Mining Standard*. Price 2s. 6d.

"*Transactions* of the University of Toronto Engineering Society." Vol. VII, No. 5. March 1913. Toronto: The Society.

"*Journal* of the Western Society of Engineers." Vol. XVIII, No. 2. February, 1913. Chicago: The Society. Price 50 cents.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXV, No. 4. April, 1913. New York: The Society. Price 35 cents.

"Annual Report of the Smithsonian Institution, 1911." Washington: Government Printing Office.

"*Journal* of the American Institute of Architects." January, February and March, 1913. Washington: The Institute. Price 50 cents each.

"Third International Congress of Refrigeration, Washington and Chicago, September, 1913." Chicago: J. F. Nickerson, secretary.

"*Bulletin* of the Association des Ingenieurs Electriciens." Vol. XII, No. 12. December, 1912. Liége: The Association. Price 7 fr.

"Chronique Illustrée du Concours International de Télégraphie Pratique, Turin, 1911." Rome: Il Ministro per le Poste e I Telegrafi.

"Elektrische Kraftübertragung in Zementfabriken." Berlin: Allgemeine Elektricitäts-Gesellschaft.

"Official Wireless Map of the World." 1913. London: George Philip & Son, Ltd. Price 2s. 6d. net.

"Post Office Electrical Engineers' Journal." Vol. 6, Part I, April, 1913. London: H. Alabaster, Gatehouse & Co. Price 1s. net.

"Electricity and its Practical Applications." By Magnus Maclean. London: Blackie & Son, Ltd. Price 10s. 6d. net.

"Third Annual Report, 1912, of the British Chamber of Commerce in Belgium." Brussels: 2, Rue de la Bourse.

"*Bulletin* of the Imperial Institute." Vol. XI, No. 1. January-March, 1913. London: John Murray. Price 2s. 6d. net.

"British Chamber of Commerce Quarterly Trade Journal." No. 21, March, 1913. Constantinople: Offices of the Chamber. Price 2s. 6d.

"*Bulletin* Mensuel of the Société Belge d'Electriciens." Vol. XXX. February, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

Bankruptcy Proceedings. — Robert Edward Joy (Bristol Electrical Co), electrical engineer, 143, Cheltenham Road, Bristol.—Application for discharge of debtor to be heard at Bristol on May 23rd.

William Longden and Vernon George Cobb (trading as Longden & Cobb), electrical engineers, 101A, Derby Road, Nottingham.—The adjourned public examination of the above-named debtors was held last week at the County Court House, St. Peter's Gate, Nottingham, when the case was formally closed.

James William Lewsley, electrician, 65, Brierley Street, late 103, Mansfield Road, Nottingham.—The adjourned public examination of this debtor was fixed to take place last week at the County Court House, St. Peter's Gate, Nottingham, before Mr. Registrar Beaumont. It was stated that criminal proceedings had been taken against the debtor in respect of certain matters connected with his failure. The Official Receiver said that in these circumstances it would be best to adjourn the examination, and the Registrar having given his consent, the case was formally adjourned.

J. G. S. Cunnington and H. P. Allison (Laing, Wharton and Cunnington), electrical engineers and contractors, Great Newport Street, London.—Last day for receipt of proofs for dividend, April 29th. Trustee, Mr. A. Page, 28, King Street, E.C.

Electrical Exports from France.—There was a large falling off last year in the value of the exports of dynamo-electric machinery from France, the returns lately issued showing a total of only £119,520, as compared with £180,700 in 1911. On the other hand, the exports of electrical apparatus increased in value from £371,840 to £423,000.

Dissolutions and Liquidations.—The partnership existing between Drennan, Glover & Cooper, electrical engineers, 427-431, Corn Exchange Buildings, Manchester, and Milburn House, Newcastle-on-Tyne, has been dissolved by mutual consent. Mr. Drennan and Mr. Cooper will continue to trade under the style of Drennan & Cooper, at the same address at Manchester, and Mr. Glover, in partnership with Mr. Bernard Gaffney, will continue under the style of Glover & Gaffney at 12, Eldon Square, Newcastle-on-Tyne. All accounts of the late firm will be attended to by Messrs. Drennan & Cooper at the old address.

Messrs. E. Reader & Sons, Ltd., Nottingham.—This company is winding up voluntarily, with Mr. W. R. Hamilton, Victoria Street, Nottingham, as liquidator. A meeting of creditors is called for April 22nd.

Wezdon Lamp Co., electric lamp agents, 22 and 23, Verulam Street, London, E.C.—Messrs. Douglas Robinson and Johan Agerup have dissolved partnership. Mr. Agerup will attend to debts.

Adams Manufacturing Co., Ltd.—We are informed that an order was made on Saturday last by Mr. Justice Swinfen Eady appointing Mr. Lewis Hardy receiver and manager on behalf of the debenture-holders of this company. It is stated that no interruption will be caused in carrying on the business, as the Receiver, under leave of the judge is to continue its business. Arrangements for the re-construction of the company are in process of being made.

Johnson-Lundell Electric Traction Co., Ltd.—Creditors should send particulars of their debts, &c., to Mr. A. E. Messer, 14, Old Jewry Chambers, E.C., the liquidator, by May 31st.

Spain.—A new company has lately been formed in Madrid with the title La Sociedad Espanola de Construcciones Electricas, to carry on an electrical engineering business.

Manufacture of Instruments and Meters.—The United States Department of Commerce and Labour has issued a special report dealing with the manufacture of electrical instruments and meters in the United Kingdom, France, Germany and Italy. The works of 31 leading firms are described, attention being paid to equipment, number of employés, and especially to the nature of the products manufactured. The report may be seen by electrical instrument makers in the United Kingdom at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Exhibition in Australia.—Steps are now being taken by the Victorian Chamber of Manufactures for carrying out the design of the Associated Chambers for holding an "All-Australian" Exhibition in Melbourne, opening in September and closing in November. The scheme of the Associated Chambers of Manufactures of Australia is to hold such an exhibition in the various States of the Commonwealth in rotation, the commencement being made in Melbourne this year. The special feature of this exhibition is to be trade processes in operation, and working exhibits.—*Australian Mining Standard.*

Water Softener Contracts.—Messrs. Lassen and Hjort have received orders from the undernoted during the last few weeks for the installation of their automatic water softeners of an aggregate capacity of 1,030,000 gallons per day.

Gas Light and Coke Co., Ltd., 150,000; Imperial Paper Mills, Gravesend, 360,000; Monton Mill Co., Eccles, 72,000; Portland Cement Co., Aberthaw, 48,000; Distillers' Co., Dundalk, 96,000; Chiswick Electricity Works, 24,000; Maxted & Knott, Storey Bros., Lancaster, Premier Portland Cement Co., Wellingborough, Brighton Schools, Brighton, 280,000 gallons per day.

The firm's water softener has been exclusively adopted by Messrs. Babcock & Wilcox, Ltd.

Catalogues and Lists.—Messrs. T. & E. Wannbacher, 5, Appold Street, London, E.C.—Leaflet No. 85, giving illustrated particulars and prices of small centrifugal pumps.

The International Electric Co., Ltd., 111-115, Salusbury Road, Kilburn, N.W.—Leaflet giving illustrations and prices of their domestic "Talkyphone," 1913 model.

Mr. Haydn Harrison, 11, Victoria Street, London, S.W.—Third edition (nearly 60 pages) of his street lighting pamphlet. This contains excellent art paper illustrations of a variety of designs of bracket arm fittings, tramway and wood-pole brackets and fittings, square type lanterns, &c., also scale drawings of lantern fittings as used at Marylebone, in the City of London, and at Harrogate, as well as similar drawings of time and half-night switches, and patent switch fuses. Other contents include patent anti-vibration lampholders, posts for high C.P. lighting and side street service, the Universal photometer, and the Harrison lightometer for testing illumination and C P. Several pages are occupied with tables and useful data respecting electric street lighting. A list of places using Harrison street fittings is given.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, Kent.—Reprint No. 508C., fully describing and illustrating their testing instruments for magnetic measurements in iron and steel works.

Messrs. Reinforced Metal, Ltd., 175, West George Street, Glasgow.—20-page pamphlet explaining their method of steel and concrete construction, known as reinforced metal, and containing a report by Prof. Andrew Gray, of Glasgow. A collection of reinforced concrete steel columns is being shown at the Building Trades Exhibition, now open at Olympia.

Messrs. Harper & Bros., 45, Albemarle Street, W.—List of books, including technical publications.

Messrs. Veritys, Ltd., London and Birmingham.—Publication No. 741 gives illustrated information respecting "Aston" portable electric lamps—pocket, hand, cycle, motor-car inspection and other types, also "Aston" electric cooking apparatus (the "Utility" cooking set, electric oven, irons, kettles, &c.). Prices are stated.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Fully illustrated catalogue (No. 5) of 44 pages relating to their manufactures for stage and theatre lighting. Among other appliances described in this publication are stage arc lamps and accessories; liquid and metallic dimmers and other resistances; Osram drawn wire lamps and Robertson lamps; cine-

matograph arc lamps and projectors; small motors for cinematograph machine work; various types of batten, electric fixtures, motor-generators, &c. Particulars are given of the "Applebee" patent screen or "Spotlight" shutter, which can be fitted to any stage arc lamp. It is attached to the inside of the lamp and operates from the back. By its use, strong shadows can be avoided, and a gradually diminishing light obtained. A clear mica-slide which is provided, prevents the projection of prismatic colouring upon the focussed object. Other features include the "Hawkins" and "Morehen" plugs. The feature of the former is that by means of detachable pins, male or female contact can be made. The latter is intended to be fixed under the stage level and provides an easy and safe method of taking temporary leads to portable stage properties. Everything mentioned in the list has been designed to meet the L.C.C. regulations. The company maintains a special dispatch department to facilitate the prompt delivery of all theatrical material. Copies of the list will be sent upon application.

Messrs. Fyfe, Wilson & Co., 155A, St. Vincent Street, Glasgow.—Catalogue No. 113 (40 pages) containing description of their Kelvin electric generating sets, specially designed for cinematograph theatres. Portable and stationary petrol or paraffin electric equipments are illustrated, and engine connection and wiring diagrams are included. Illustrations and tabulated prices and code-words appear of rotary transformers for cinematographs, motor-generators, model cinematographs and special arc lamps for same, and resistances, "Sunrae" flame arc lamps, cables and wires, and lamps and other lines are particularised.

The British Thomson-Houston Co., Ltd., Rugby.—New price lists as follows:—No. 5,531 (8 pages), fully describing and showing their automatic time switches; No. 4,155 (8 pages), similarly dealing with their type O, form E, oil-break switches.

Electricity at the Clothing and Outfitting Exhibition.—One does not expect to find a very large array of electrical exhibits at an Exhibition devoted to the clothing trade. As a matter of fact, the only display at the Clothing and Outfitting Exhibition, which opened at the Agricultural Hall, London, on Monday last, which calls for notice, is that of Messrs. Eastman and Warne, of 241, Acton Vale, W., who are showing a range of "Hot Point" electric hand irons, which are, we understand, now being used all over the kingdom in laundries, clothiers', dressmakers', hatters', and similar workrooms. The feature of the "Hot Point" electric hand irons lies in the fact that they offer an exact substitute for the usual stove or gas-heated iron, without the use of the long cord usually employed for conveying the current to the iron, and which often prevents them being as handy as the old-fashioned stove-heated irons. In other words, in place of being continuously heated, they are given a heating as desired by being placed on a shelf covered with fireproof material, and provided with guides to take the irons; short pillars on the latter making contact with springs in contact boxes at the back of the shelves. When contact with the source of current is made, the irons are heated up by converters, consisting of long windings of fine wire round asbestos strips, embedded in the box of the iron, provision being made to cut down the current gradually as the temperature rises, thus securing economy and preventing any risk of burning out. The system was developed in the works of Messrs. Eastman & Sons (Dyers and Cleaners), Ltd., who have used electric irons in their finishing department for the last 12 years, and who are working with Messrs. Eastman & Warne. The electric irons can be heated just as quickly as a stove-heated one, and retain their heat equally as long; when an iron has become cool the operator has merely to push it into position on the heating shelf and pull out a fully-heated one. We are informed that a careful comparative test of the "Hot Point" irons with those heated by gas resulted in the former showing an economy of about 40 per cent. Messrs. Eastman & Warne have also on view an electric branding machine for branding names on anything from furniture to pigs (!) and also an "Eadisk," which is the electric equivalent of a gas boiling or heating ring.

Trade Announcements.—Messrs. Berry, Skinner and Co. announce that they have granted to the Safetee Controlling Appliances Co., Ltd., of Lutop, Beds., a limited licence under Berry's patents Nos. 28,546/04 and 13,443/09 to manufacture and vend in the British Isles, under royalty, their apparatus advertised as the "Safetee" switch-fuse.

The Premier Electric Control, Ltd., have removed to Kenmont Works, Harrow Road, Willesden Junction, N.W.

For Sale.—The Birmingham Tramways Committee has for disposal the whole of the machinery and plant installed at the Yardley generating station. Messrs. Wheatley Kirk, Price & Co. will, on May 7th and 8th, sell by auction the freehold works premises, the entire plant, stock and goodwill of the business of the Sunbeam Lamp Co., Ltd., (in liquidation).

Messrs. J. & W. Heathcote will, on May 2nd, sell by auction the factory premises of Metalite, Ltd., Derby. See our advertisement pages in this issue.

LIGHTING and POWER NOTES.

Aberdeen.—An installation of electric light is now being made at Crathie Church, on the Lister-Bruston system; improvements in the lighting of Balmoral Castle are also said to be in contemplation, and here also electricity will play an important part.

Basingstoke.—At a meeting of the T.C., the draft provisional order for electric supply in the town and neighbouring parishes was received. The order approves of the local proposals with a few additions to the details.

Bedford.—The adjourned L.G.B. inquiry into the application of the T.C. for borrowing powers for the purchase of Diesel engine plant was held on the 10th inst., when the allegations of the Hick-Diesel Co. in regard to the manner in which the contract was placed with Messrs. Allen were fully gone into. The Town Clerk pointed out that Messrs. Allen's tender (for a 400-kw. set) including spares, and allowing for the cost of altering the roof incidental to acceptance of the Hick-Diesel tender (for a 500-kw. set) was less costly, also that the Hicks engine not being enclosed did not comply with the specification. It was stated that Messrs. Allen had not made a Diesel engine, and that their London representative had tried to induce the Hick-Diesel firm to facilitate Messrs. Allen's tender going through. The inquiry was concluded.

Birmingham.—The Electric Supply Committee of the City Council has decided to recommend that a sum of £250,000 be spent on a new power station at Nechells to supplement the existing one at Summer Lane. This, however, is only an instalment of a scheme which will ultimately cost nearly £1,000,000.

Burnham (Somerset).—With reference to the electricity scheme submitted by Dr. Purves, of Exeter, which was referred to in a recent issue of the Electrical Review, the U.D.C. has decided to grant Dr. Purves an extension of time until May 8th, to register his electric light company under the Council's Parliamentary Order. It is anticipated that this extension will enable the scheme to be carried out without further delay.

Canada.—Supply to Farmers.—The *Electrical News*, in a recent issue, referred to the development of the Electric Power Co.'s system, from which several pulp and paper mills are supplied. Our contemporary says the peak load on this system has grown very rapidly, and in December, 1912, just three years after the Stephens Dam power house commenced operation with a load of 300 h.p., the peak had grown to 15,000 h.p., with a daily load factor usually exceeding 80 per cent. Although the company has such excellent consumers as pulp mills, yet it apparently does not neglect the smaller classes of supply.

In order to satisfy the growing demand for electric light and power in rural districts the company is now actively engaged in building a number of rural distribution lines. One of these, viz., a 2,200-volt, single-phase line, about 10 miles in length, from Napanee through Newburg to Camden East, has now been in operation for some time. It is fed from the company's sub-station at Napanee. Distributed over the 10 miles of line are now about 60 customers.

Another of these lines, extending about 12 miles in a south-easterly direction from Campbellford, will be in operation before the end of the present month, with between 20 and 25 customers, most of whom have contracted for from 1 to 3 h.p. There is also one customer on this line who has contracted for 25 h.p. The line will be fed from the Stephens Dam power house at Campbellford at 6,600 volts, single phase. Pole type transformers are used, having a ratio of from 6,600 to 120/240 volts. As a rule a separate transformer is installed for each customer.

Other lines are in prospect, and will be constructed in the near future, extending over 29 miles. The farmers along the routes of these lines are having their houses and barns wired for lighting and are installing motors for pumping water, sawing wood, chopping feed and various other purposes.

Carlisle.—The T.C. on the 8th inst., authorised the Electricity Committee to apply for sanction to borrow £7,500 for additional plant which is needed for the supply of two large business premises.

Cheltenham.—At the last meeting of the T.C., the electrical engineer was instructed to obtain tenders for additional condensing plant at the works. The loan of £1,500 sanctioned in May, 1900, for mains extensions being nearly exhausted, it was resolved to apply for sanction to a further loan of £1,500. It was stated that in the last four months the consumers added had been 103, compared with 35 in the corresponding period last year.

Colwyn Bay.—At a meeting of the U.D.C. a communication was submitted from the North Wales Power Co., which owns the power station in Nant Gwynant, stating that it intended to extend its mains to Penmaenmawr, and that it observed the U.D.C. was about to spend £5,000 for additional generating plant. The company suggested that this expense might be saved, and the cost of electricity supply in the town reduced if the company's mains were continued to Colwyn Bay and current were supplied to the Council in bulk. It was decided to refer the letter to the Electricity Committee.

Continental Notes.—Hungary.—Plant is about to be put down at Zwir to utilise the water-power of the River Reesina in the generation of electrical energy for lighting and power purposes in the town of Fiume. The water will be diverted from the river at Cankovo and conveyed along a canal, about 18 miles long to Zwir, where the existing steam-operated generating plant will be kept as a reserve, when the new installation is completed.

France.—Owing to the increasing demand for current, La Société Est-Electrique is extending its central station at Mohon by putting down a new 12,000-h.p. steam turbine and generator. When the new plant is installed, the station will have a total capacity of 24,000 h.p.

Coventry.—Mr. Hooper and Rate-Aid Contributions.—A L.G.B. inquiry has been held into an application by the Corporation for sanction for a loan of £20,000 for electricity department extensions. The loan was intended to cover an overdraft of £16,357, and to provide for further capital expenditure, principally upon mains. The Inspector (Mr. R. H. Hooper) observed that last year the undertaking made a profit of £16,000, of which £4,000 was paid to the relief of the rates. He pointed out that the outstanding capital was increasing each year, whereas in a good many municipal undertakings the outstanding capital was dropping; and when it began to drop, then they began to get a far more valuable asset for the town. He did not question at all that the undertaking did very well in making a profit of £16,000, but he pointed out that they were placing money to the relief of the rates, and then having to borrow really in order to do so. There were no two ways out of it; it must cost the ratepayers more in the long run, because they would have to pay the interest and charges upon the borrowed money. He also pointed out that the poorer class of people paid their rents and rates in one lump sum, and that money devoted to the relief of rates in an undertaking of that character was of no benefit to that class of people; in fact, it was no relief whatever to the poorer working classes. There were just over 2,000 consumers of electrical energy out of a population of 115,000, so that practically one-fiftieth of the population were making a contribution to the relief of the rates for the benefit of the others, who did not happen to be users of electrical energy. He hoped the City Council would very seriously consider the question of these large contributions to the relief of the rates; it was very much sounder, financially, for the whole of the undertaking and for the city that the whole of the profits should be conserved. Alderman West inquired as to the opinion of the Inspector with regard to other municipal undertakings. The Inspector replied that the principle applied equally to them all, and said he had noticed that in towns where there were no contributions to the relief of the rates from municipal undertakings, the rates were extraordinarily low. The inquiry closed, and the Inspector notified that he would report in due course.

Cromer.—Notice of the intention of the Council to transfer its prov. order to Edmundson's Corporation, with the consent of the B. of T., appears in the *London Gazette* for April 11th.

Dundalk.—On the 28th inst. a L.G.B. inquiry will be held into the application of the Urban Council for sanction to obtain a loan of £5,000 to extend the electric lighting system of the town.

Epsom.—The U.D.C. has decided to offer existing consumers of electricity for outside shop lighting a supply of current at the rate of £3 10s. per lamp per annum, or an alternative charge of 2d. per unit.

Falkirk.—The T.C. is considering whether electricity or gas should be adopted for street lighting. An early meeting will deal with the reports of the electrical and gas engineers, and decide as to the best and most economical method.

Fleetwood.—The L.G.B. has sanctioned the following loans in connection with the electricity undertaking: £5,240 for 17 years, £1,410 for 15 years, and £500 for 30 years.

Haiti.—Electric lighting already exists at Port-au-Prince, Cape Haytien and Gonaives, and every year it is employed more in the streets and to light private houses. One company supplies the current to the first two towns mentioned above. Its station is at Port-au-Prince; the station at Cape Haytien is much less important. Electric lighting at Gonaives is in the hands of the Haiti Lighting Co., which has a capital of £20,000. The station of this company has two engines each of 66 H.P., and 40-KW. dynamos. A German firm intends to develop and improve the electric installation at Port-au-Prince. Power is to be supplied and the tramways electrified in that town, a contract having already been entered into with the Government. Over and above the three towns mentioned above, electric lighting could, says a correspondent, be installed with success at St. Mark, Mole St. Nicholas, Mixagoane, Petit-Goave and Aquin; also at Jacmel, where there used to be an electric lighting company. At Petit-Goave there are large works for the treatment of coffee. These are now worked by steam, but there should certainly be an opening for the use of electricity in them. A large number of small works in Haiti could be operated by electricity without much expense, as there are plenty of waterfalls which could be utilised to supply the power.

India.—According to the *Calcutta Englishman*, Howrah (Bengal) will be electrically lighted throughout by August next. At present 800 street lamps are in use; these will be superseded by 1,500 50-C.P. lamps lighting all the streets and roads in the town. The supply is obtained from the Calcutta Electric Supply Corporation, which has laid 6,000-volt cables through the Hooghley.

The *Pioneer* gave some details of the Simla hydro-electric scheme in a recent issue, from which is appears that the power house contains three 250-KW. Pelton wheel units operating under a head of 540 ft., and delivering energy at 2,200 volts, subsequently stepped up to 15,000-volts pressure for transmission to Simla direct, 9 miles, and to a pumping station at Chair, 12 miles; the pumping station is also connected to Simla by a 7½-mile transmission. At Simla the pressure is reduced to 2,300 volts, and subsequently reduced again in small sub-stations to 220 volts for street and house lighting. The additional water required at Simla led to the carrying out of the project; the pumping station is equipped with two induction motors driving slow-speed plunger pumps, and the older pumping station for the Simla water supply is also to be electrified. The cost of the hydro-electric scheme is put at Rs. 1,320,000.

Arrangements have at last matured for the introduction of electric lighting and power in the three cities of Lucknow, Allahabad, and Bareilly. Tenders for the work will be invited forthwith.

Kearsley (Lancs.).—At a meeting of the D.C., held on April 10th, the surveyor reported on the lighting of Kearsley Hall Road and Slackey Brow by electricity, and it was resolved not to go to the expense involved.

King's Lynn.—At a recent meeting, the T.C. adopted a report of the Electricity Committee which stated that the electrical engineer had reported that, on account of continued abnormal increase in the demand for current, it was impossible to consider the gas engines, even if improved in accordance with previous suggestions, as an effective stand-by. He therefore asked the Committee to arrange for the installation of an additional 400-KW. steam set, with necessary pipes and apparatus, at an estimated cost of £3,000. The Committee recommended that one gas engine and dynamo be advertised for immediate sale, that the other gas engines and dynamos be sold as occasion arises, and that the necessary tenders be invited for the installation of a 400-KW. steam set.

Lerwick.—The T.C. is about to consider the question of lighting the town by electricity.

Llandudno.—The U.D.C. has decided to have mains laid in Augusta Street, Madoc Street and Chapel Street, in order that those thoroughfares can be lighted by electricity. The capital cost will be £270, and the annual cost of 400-C.P. lamps, £3 15s. each.

London.—Poplar.—Tenders are invited from recognised makers of converting plant for the provision at the Farmgate sub-station at Millwall of one 1,000-KW. converter with the necessary switchgear and connections. The E.H.T. mains are to be extended by the laying of 5,000 yards of '15 sq. in. 6,000-volt cable from the main generating station to the Millwall sub-station at an approximate cost of £3,533. This work was first recommended by the engineer in March, 1912, but owing at the time to the rapid rise in the price of copper and lead, the proposal was deferred.

Stoke Newington.—Application is to be made to the L.C.C. for sanction to borrow £5,000 for mains, and £1,000 for meters.

Stepney.—The Electricity Committee reports having had under consideration a communication from the Comptroller of the L.C.C., notifying the following alterations in the maximum periods which will in future be sanctioned by that authority for the repayment of loans for electric lighting purposes:—Freehold land (*a*) new period 60 years, (*b*) old period 60 years; buildings (*a*) 30 years, (*b*) 50; mains (*a*) 25 years, (*b*) 30; plant and machinery (*a*) 15 years, (*b*) 20; house connections (*a*) 12 years, (*b*) 12; meters (*a*) 10 years, (*b*) 10 According to a report, the Committee states, which has been prepared by the borough treasurer and the borough electrical engineer and manager, it appears that the proposed reductions in the periods in question are not justified; and, moreover, are calculated to injuriously affect municipal electricity undertakings in the metropolis. The attention of the Standing Conference of the five East End Boroughs of Poplar, Stepney, Hackney, Shoreditch and Bethnal Green was then drawn to the matter, with the object of a conference of the whole of the local authorities in the metropolis owning electricity undertakings being convened, in order that concerted action might be taken in the matter, with the result that the Conference decided to adopt the course suggested.

Hammersmith.—The Electricity Committee reports having considered the general working of the scheme approved by the Council in December, 1911, for hiring and maintaining arc lamps on consumers' premises. This scheme, the Committee states, at present allows only for a maximum guaranteed consumption during 800 hours per annum, but in actual practice, it is found that a number of consumers exceed this to a considerable extent. The Committee is, therefore, extending the scale of charges so that the guaranteed hours' use per annum can be extended to 900 and 1,000 hours, the rental being increased *pro rata*. The Committee is also proposing to give lower rates in consideration of the consumer entering into a contract at the expiration of the first 12 months, to continue the use of the lamps for a further period of four years.

Hackney.—In view of the large expenditure which has taken place in the capital expenditure of the electricity undertaking, the B.C. is pressing forward the sales and publicity sections so as to make the business take a corresponding step forward, and in view of this have decided to have full-page advertisements in certain papers once a month, the centre of the page to be devoted to an appropriate general popular article, and the margin to be let for traders' announcements.

Luton.—The assessment of the Corporation Electricity Works has been reduced from £3,000 to £1,500, without resorting to an appeal.

Lye and Wollescote.—The U.D.C. has appointed a Committee to consider the advisability of having the town lit by electricity in place of gas. As an experiment, it is proposed to have one street electrically illuminated.

Lytham.—The B. of T. has given its decision as to who shall have power to supply electricity to the district, the application of the local Council having been acceded to. The application of the St, Anne's U.D.C. has been refused,

Merton.—The Wimbledon T.C. has offered to provide, erect, and maintain public electric lamp standards at Merton, fitted with 500-550 watt lamps, at £27 10s. per lamp per annum, for a term of not less than 10 years. This offer is being considered by the Merton U.D.C.

Portrush.—Mr. G. B. Deane held a L.G.B. inquiry last week in connection with application of the Urban Council for sanction to raise a loan of £6,000 for the purpose of carrying out the long projected electrical lighting scheme.

Plymouth.—The secretary of the B.E.A.M.A. has written the Corporation, enclosing the copy of a printed form entitled "Municipal Tenders, Request as to Publication," pointing out that it had been agreed between the Association and the I.M.E.A. that the publication in the Press, local or general, of prices quoted on financial tenders and reports of electricity committees on municipal tenders was undesirable, both in the interests of municipalities and manufacturers. The Corporation was requested to take steps with a view to avoiding such publication. The Electricity Committee referred the matter to the Town Clerk for report.

Richmond.—At the last meeting of the T.C. a letter was read from the Richmond (Surrey) Electric Light and Power Co., Ltd, intimating that the company is advised that it is necessary to have the agreement which was made between the Corporation and the company in January last confirmed by an Act of Parliament, and that the Lord Chairman having allowed the company to proceed by a late Bill, the company is taking the necessary steps to deal with the matter this session. In this connection, the General Purposes Committee reported that the agreement referred to provided for its confirmation by Parliament if the company should consider this to be necessary, but the Parliamentary Notice foreshadowed provisions which did not appear to be in accordance with that agreement. Mr. Renwick, the company's general manager, suggested that certain provisions relating to the price of current contained in the original agreement scheduled to the Companies' Act of 1907 are cancelled by the provisions of the recent agreement, and he has submitted a draft supplemental agreement to provide for the repeal of so much of those provisions of the original agreement as relate to the revision of the price of current. The Committee advised the Council to oppose the Bill if necessary, and this was agreed to.

St. Andrews.—The Electric Supply Corporation is anxious to obtain a contract for lighting the streets of the city with incandescent electric lamps, and is fitting up lights in Greyfriars Gardens as an experiment.

Stoke-on-Trent.—The B. of T. has granted the T.C. a prov. order empowering the Corporation to supply current for public and private purposes at Wolstanton.

Southborough.—The B. of T. has granted the U.D.C. a prov. order for electric lighting.

Swanage.—The Electricity Supply Co. has applied to the Board of Trade for permission to erect a generating station at Court Hill, under the Electric Lighting Order, 1906.

U.S.A.—The Commissioner of Public Works of Boston, Mass., in his annual report, urges the installation of electric lamps in place of the 11,000 gas lamps now in use for city lighting. He says that 60-C.P. tungsten lamps, giving one-third more light than the present gas lamps, cost $21.14 per lamp per year and their use would save the city $21,716 a year over the present contract price paid for gas lamps.

Wednesbury.—The T.C. has decided to increase the charges for electricity for light and power, by 5 per cent., from April 1st.

West Bromwich.—A recent issue of the *Midland Chronicle* illustrates the improved lighting in Birmingham Road, where the Cable Accessories Co.'s "Seaco" sheet steel tungsten lamp fittings have been adopted. The fittings in question apparently contain five 100-C.P. lamps, and are hung direct from the tramway span wires. It may be mentioned that the lampholders are mounted on a spring-supported insulating base which gets over vibration difficulties.

The T.C. has received from the L.G.B. sanction to a loan of £6,500 for mains extensions. The Electricity Committee has been authorised to negotiate with the South Staffs. Tramways (Lessee) Co., Ltd., for a further supply of energy.

Whitehaven.—The T.C. has received from the L.G.B. sanction to loans of £665 in respect of excess expenditure on plant, £300 for mains extensions, and £600 for house services.

Whitstable.—The U.D.C. has decided, by 7 votes to 5, to agree to the installation of the electric lighting in the town on terms to be arranged with a proposed company, and that the latter be given half of the public lighting, subject to a proper agreement being entered into.

Wolverhampton.—In consequence of the continued rapid growth of the demand for electrical energy—particularly in the centre of the town and in the Dudley Road area—it is found necessary to again make extensions to the Corporation electrical plants and mains. Just before severing his connection with the undertaking Mr. C. E. C. Shawfield, the electrical engineer, prepared a report setting forth the requirements to meet next winter's load. He recommends the laying of a H.T. ring main from Commercial Road to the School Street Stores, from the Stores to the Sunbeam Works, returning to Commercial Road. That a sub-station be built at the Stores, with three 250-KW. rotary converters with the necessary switchgear; and to install in a sub-station at the Moorfield Works of the Sunbeam Motor Car Co. one 250-KW. converter. Mr. Shawfield also states that extensions will be required to the E.H.T. switchboard to deal with the proposed ring main. There is no room for further extensions to the existing E.H.T. switchboard without going to very considerable expense. In view of this fact he recommends that a new switchboard be installed. The generating and converting plant will be controlled by this switchboard, the present board being used as an auxiliary switchboard to control feeders only. A further advantage of this scheme is that the switchgear for all the running plant, both A.C. and D.C., will be collected at one point, and will be under the control of one man, an arrangement desirable on the grounds of economy and efficiency. The expenditure required to meet the cost of the scheme is estimated as follows:—E.H.T. ring main, £3,300; feeder cables to various points on the network, £550; alterations to existing network, £400; four 250-KW. converters, £3,000; E.H.T. switchgear for three sub-stations, £900; L.T. switchgear for three sub-stations and cable connections, £600; buildings and foundations, £570; cranes for two sub-stations, £150; new E.H.T. switchgear for Commercial Road generating station, £2,000; new cables for connecting existing machines, £150; or a total of £11,620.

Mr. Shawfield concludes his report with the following practical recommendation: "That an application be made to the L.G.B. to borrow a further sum of £15,000 for mains extensions, and £5,000 for sub-station equipment. Also that application be made to them to borrow £2,000 for E.H.T. switchgear and connections at the generating station, Commercial Road."

At the Council meeting following, Mr. Shawfield's report was unanimously adopted, and tenders are to be invited for the necessary work.

Woodford (Essex).—The U.D.C., after considering a scheme of obtaining a supply of current from Walthamstow Council, has deferred its decision until the ratepayers have had an opportunity of discussing the matter.

Worthing.—In introducing the half-yearly estimates to the T.C., Alderman White referred with pleasure to the fact that the accounts of the electricity undertaking were at last showing an appreciable profit. After placing £500 to reserve, the outcome of the past year's trading had been a realised profit of £748. Electric heating and power were appealing to the townspeople, with the result that it was expected that during the coming year something like 160,000 units would be sold for these purposes, representing an income of something like £1,000. It was proposed that in future this sum should be deducted from the cost of producing the electricity before calculating the charge for public lighting, and this would mean that whereas during the past year the charge for public lighting had approximated 5d. per unit, it would in future be about 4·1d. The Committee estimated that 12 months hence there would be a balance of profit of something like £1,500, and he hoped that then not only the public lighting, but also the private consumers would benefit by a reduction.

York.—The T.C. has received from the L.G.B. sanction to a loan of £500 for wiring Corporation premises for the electric lighting.

The Electric Light Committee is to prepare a scheme for laying cables in the streets of the city, generally for public and domestic lighting, and other domestic purposes. The capital cost of such a scheme is estimated at £71,000, and it is anticipated that the public lighting could be undertaken at £3,075 a year, including interest on the loan, against £4,600 paid for gas.

TRAMWAY and RAILWAY NOTES.

Barking.—It has been decided to agree in principle to the proposed traction supply from East Ham upon certain terms which were not made public, and the matter was left to the clerk and engineer to arrange the necessary details.

Bournemouth.—The financial year of the Corporation tramways undertaking shows that all previous records have been broken. The number of passengers carried was over 15,750,000, showing an increase of about 640,000. The receipts were nearly £95,700, an advance of about £4,340. There has also been a substantial saving in expenditure, and there is, it is stated, a balance of over £10,000 on the net revenue account.

Canada.—The *Electrical News* says that the train service operated by the Grand Trunk Railway system through the St. Clair tunnel which connects Sarnia and Port Huron under the St. Clair river is claimed to be the heaviest railway service handled by electricity in the world. This electrification operates within a zone of approximately four miles, the motive power being derived from 1,500-H.P. electric locomotives, each weighing 135 tons with a normal draw-bar pull of 50,000 lb. and a maximum speed of 35 miles per hour. The time taken to change engines is from two to five minutes, and the time of passing through the tunnel which, with its approaches is more than two miles in length, is 13 minutes. Up

to 45 cars per train are hauled through the tunnel, which represents a train more than one-half mile in length.

During the 12 months of 1912 the company's records show that 197,801 loaded freight cars and 88,692 empties passed through the tunnel, in addition to 35,096 passenger cars. Estimated on a basis of 17 tons per car, this gives a total tonnage passing through the tunnel of approximately 3,500,000. These figures do not include any company material such as coal, lumber, ties, &c., which would swell the total to much larger proportions.

Cardiff.—The tramway receipts show an increase of £3,263 over the previous financial year, due largely to the Royal visit in June last, and the fact that Easter came much earlier, but Mr. Arthur Ellis and his staff are to be congratulated on the financial result. The number of transfer tickets issued during the year was 3,037,720, which compared with the figures of the preceding year—2,900,700—gives an increase of 137,000. The figures are as follows:—1913, passengers, 28,365,037; receipts, £128,882; 1912, passengers, 27,561,652; receipts, £125,618. The question whether some of the Cardiff thoroughfares should be remade and a portion of the tramway line reconstructed by contract or direct labour was discussed by the Tramways Committee. The Lord Mayor, referring to the decision of the Joint Committee to employ direct labour, said he would like to know whether the statement made by the city engineer that £27,000 could have been saved if the track had been relaid by direct labour in 1902 was accurate. The following resolution was ultimately passed:—"It is the opinion of the Committee that (*a*) the whole of the works involving reconstruction of the tramway track and repairing of the carriage ways should be carried out by the same agency, and (*b*) that before deciding the question of contract as against direct labour, tenders be invited by advertisement, and that the city engineer be requested to submit his estimate to be opened at the same time as tenders received from contractors. The whole of the work to be done to a specification, and schedule of prices to be prepared by the city engineer.

Doncaster.—Now that the district is growing so quickly through colliery development, an effort is to be made to compel the Corporation to fall in with the desires of the people, and provide a means of transit on the Sabbath. Some years ago the question was submitted to the referendum, but the area of the plebiscite was restricted to the borough, and the majority of the few who voted at all, were against such a service. If a poll were taken now, including the outside districts, there would be an overwhelming majority in favour of Sunday running.

Edinburgh.—The convener of the Tramway Committee, along with the town clerk, has had an interview with the War Office authorities with reference to the Colinton Tramway and to the application of the company for running powers in the city. It is stated that negotiations have been proceeding for the acquisition of the tramway by the Corporation, and that £10,000 has been mentioned as the price at which the promoters are willing to sell. The tramway runs between Slateford Station and Redford Barracks. The purchase by the Corporation would solve two questions in which the War Office is interested—the supply of electric lighting to the barracks and the provision of tramway facilities for the soldiers. It has still to be decided whether the city or the War Office will lay the mains from the city boundaries to Redford.

Hull.—In connection with the agitation for a tramway service from the centre of Hull to Stoneferry, which is within the city boundary, a largely attended meeting has been held at Stoneferry, when a resolution was passed in favour of the extension of the tramways. A motor-'bus service used to be run, but this was discontinued as it entailed a loss of £5,000 per annum. Alderman Hanger said that out of the tramway profits, £190,500 had been contributed to the relief of the rates. Four hundred yards of the double lines were already laid of the 1½ miles required, and he held that the profits should be used for the development of the system.

Leicester.—The T.C. has approved the report of the Tramways Committee recommending the provision of repairing shops for tramway cars in the Abbey Park Road, at an estimated cost of £23,000.

London.—On Monday last another stoppage of the L.C.C. tramway service, both north and south of the Thames, took place for two hours during the busiest part of the morning. Following on two similar breakdowns, it is not surprising that some discussion took place in the Council on the matter, which appears to have been somewhat unnecessarily hushed up.

A report presented by the Highways Committee on the two tramway breakdowns which occurred on March 10th and 12th respectively, stated that on the evening of March 10th a short-circuit occurred on the switchgear at the Greenwich generating station, causing considerable damage to the switchgear, burning out several coils on a generator, and involving a temporary failure of the whole supply. A partial supply was given within a few minutes, and the normal supply was resumed the same evening. On March 12th, a few coils of another generator failed. These had apparently been weakened previously. By working day and night, the first generator damaged was on load again on March 19th, and a large proportion of the cars which had been withdrawn were put back into service. The repair of the second generator was completed on March 29th, and the full service of cars was resumed on March 30th.

Sir Edward White, chairman, Highways Committee, said they had received tenders for the supply of improved turbine machinery, at a cost of something like £200,000. This would give them considerable reserve power; but they were not depending entirely on this. They had a contract with the Metropolitan Electric Tramway Co. to supply them with a certain amount of power, and under that contract power was being supplied to them now. They had also a contract with one of the public authorities, and cables were being laid down in order to give them a third string to their bow. They were thus taking every means in their power to meet the difficulties.

Mr. G. H. Hume, vice-chairman, Highways Committee, said none of the three accidents had anything to do with an over-demand on the resources of the generating station. That on March 10th was due to a slight error of judgment. On Monday last a piston was blown out of one of the engines, owing to the breaking of a cotter-pin, and a piece struck a generator. That caused a short-circuit, which in turn caused a short-circuit on the high-tension board. A section of the switchboard caught fire, and the same generator which broke down in March gave way in another place. The whole service had to be stopped while the fire was being put out, and the extent of the damage was being ascertained. It was no use the Council blinking at the fact that they were working with a very small margin at their generating station. After further discussion the matter dropped.

The total traffic receipts of the L.C.C. tramways for the year April 1st, 1912—March 31st, 1913, were £2,143,190 from electrical lines, and £37,545 from horse tramways. The comparable receipts for the previous year were £2,231,945 and £60,356, showing a decrease of over £111,000.

STEPNEY.—The L.C.C. is to be requested to include in one of its General Powers Bills a clause to empower a Council to recover the cost of damage done to street lamp columns from the owner or owners of the vehicle, instead of from the driver as at present.

Manchester.—At a meeting of the Tramways Committee recently, the estimates for the ensuing year were considered. By resolution of the City Council, and in accordance with the scheme of the Trading Profits Committee, the tramways undertaking is expected to contribute £100,000 to rate relief purposes, being 5 per cent. on a capital expenditure of, roughly, £2,000,000. The estimated receipts for the ensuing year are put at over £900,000. The capital expenditure account makes provision for £30,000 for buildings, £30,000 for permanent way (new lines), £25,000 for street improvements, and £30,000 for cars and equipment.

Nelson.—A record year is reported in connection with the tramways undertaking. The Committee estimated a profit of £450, but this has been exceeded by no less than £1,000. The light railways have carried 267,271 more passengers than in the previous year, notwithstanding the fact that last summer was an abnormally wet one. The most gratifying feature is the great improvement which has taken place in regard to the Scotland Road section, which has hitherto been a great drag on the undertaking.

TELEGRAPH and TELEPHONE NOTES.

Direct Cable to Canada.—Direct telegraphic communication between the United Kingdom and Canada has been opened, on the Morse system of Mr. John Gott.

Rural Telephones.—In answer to a question, the Postmaster-General recently stated that the additional Treasury grant of £20,000 would probably admit of the provision of about 1,300 additional rural party-line telephones.

United States.—It has been announced that a contract for eight wireless telegraph stations, to be the most powerful in the world, has been awarded by the American Marconi Wireless Telegraph Co. to the J. G. White Engineering Corporation. The stations will be located in pairs, a receiving and a sending station being 30 miles apart to reduce interference, at Oahu, H.I.; Tamales Bay and Bolinas, Cal.; near Belmar, N.J., and in Eastern Massachusetts. Later on a station will be established in Japan. The range of these stations is estimated at from 4,000 to 6,000 miles, and each will utilise a different wave-length. The antennæ will be 400 ft. or more high. Each station is to consist of 12 towers arranged in a semicircle covering a square mile. The power available at each station will be 750 KW.—*Electrical Review and Western Electrician.*

Wireless Map of the World.—An admirable map of the world has been compiled by Marconi's Wireless Telegraph Co., Ltd., and is published by Messrs. George Philip & Son, Ltd., at 2s. 6d. net. It shows very clearly the position of all stations open for ship-and-shore communication, high-power public and private stations, the long-distance stations of the Imperial scheme, and other stations for trans-oceanic communication. Lighthouse, lightship and Naval stations are not shown, and this, perhaps, accounts for the omission of the stations at the Eiffel Tower and Nauen, for example, though we were not aware that these were regarded as "Naval." The distribution of the stations over the world is very interesting; Canada is thickly dotted with them along the St. Lawrence and the great lakes, as well as on the West coast. British East Africa, the Gulf of Mexico, and the East coast of South America are also noticeably well equipped, but the greatest concentration is, of course, in the West and South of Europe. The map is very welcome, and certainly fills a distinct want.

(*Continued on page 647.*)

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During the 12 months of 1912 the company's records show that 197,801 loaded freight cars and 88,692 empties passed through the tunnel, in addition to 35,096 passenger cars. Estimated on a basis of 17 tons per car, this gives a total tonnage passing through the tunnel of approximately 3,500,000. These figures do not include any company material such as coal, lumber, ties, &c., which would swell the total to much larger proportions.

Cardiff.—The tramway receipts show an increase of £3,263 over the previous financial year, due largely to the Royal visit in June last, and the fact that Easter came much earlier, but Mr. Arthur Ellis and his staff are to be congratulated on the financial result. The number of transfer tickets issued during the year was 3,037,720, which compared with the figures of the preceding year—2,900,700—gives an increase of 137,000. The figures are as follows:—1913, passengers, 28,365,037; receipts, £128,882; 1912, passengers, 27,561,652; receipts, £125,618. The question whether some of the Cardiff thoroughfares should be remade and a portion of the tramway line reconstructed by contract or direct labour was discussed by the Tramways Committee. The Lord Mayor, referring to the decision of the Joint Committee to employ direct labour, said he would like to know whether the statement made by the city engineer that £27,000 could have been saved if the track had been relaid by direct labour in 1902 was accurate. The following resolution was ultimately passed:—"It is the opinion of the Committee that (*a*) the whole of the works involving reconstruction of the tramway track and repairing of the carriage ways should be carried out by the same agency, and (*b*) that before deciding the question of contract as against direct labour, tenders be invited by advertisement, and that the city engineer be requested to submit his estimate to be opened at the same time as tenders received from contractors. The whole of the work to be done to a specification, and schedule of prices to be prepared by the city engineer.

Doncaster.—Now that the district is growing so quickly through colliery development, an effort is to be made to compel the Corporation to fall in with the desires of the people, and provide a means of transit on the Sabbath. Some years ago the question was submitted to the referendum, but the area of the plebiscite was restricted to the borough, and the majority of the few who voted at all, were against such a service. If a poll were taken now, including the outside districts, there would be an overwhelming majority in favour of Sunday running.

Edinburgh.—The convener of the Tramway Committee, along with the town clerk, has had an interview with the War Office authorities with reference to the Colinton Tramway and to the application of the company for running powers in the city. It is stated that negotiations have been proceeding for the acquisition of the tramway by the Corporation, and that £10,000 has been mentioned as the price at which the promoters are willing to sell. The tramway runs between Slateford Station and Redford Barracks. The purchase by the Corporation would solve two questions in which the War Office is interested—the supply of electric lighting to the barracks and the provision of tramway facilities for the soldiers. It has still to be decided whether the city or the War Office will lay the mains from the city boundaries to Redford.

Hull.—In connection with the agitation for a tramway service from the centre of Hull to Stoneferry, which is within the city boundary, a largely attended meeting has been held at Stoneferry, when a resolution was passed in favour of the extension of the tramways. A motor-'bus service used to be run, but this was discontinued as it entailed a loss of £5,000 per annum. Alderman Hanger said that out of the tramway profits, £190,500 had been contributed to the relief of the rates. Four hundred yards of the double lines were already laid of the 1½ miles required, and he held that the profits should be used for the development of the system.

Leicester.—The T.C. has approved the report of the Tramways Committee recommending the provision of repairing shops for tramway cars in the Abbey Park Road, at an estimated cost of £23,000.

London.—On Monday last another stoppage of the L.C.C. tramway service, both north and south of the Thames, took place for two hours during the busiest part of the morning. Following on two similar breakdowns, it is not surprising that some discussion took place in the Council on the matter, which appears to have been somewhat unnecessarily hushed up.

A report presented by the Highways Committee on the two tramway breakdowns which occurred on March 10th and 12th respectively, stated that on the evening of March 10th a short-circuit occurred on the switchgear at the Greenwich generating station, causing considerable damage to the switchgear, burning out several coils on a generator, and involving a temporary failure of the whole supply. A partial supply was given within a few minutes, and the normal supply was resumed the same evening. On March 12th, a few coils of another generator failed. These had apparently been weakened previously. By working day and night, the first generator damaged was on load again on March 19th, and a large proportion of the cars which had been withdrawn were put back into service. The repair of the second generator was completed on March 29th, and the full service of cars was resumed on March 30th.

Sir Edward White, chairman, Highways Committee, said they had received tenders for the supply of improved turbine machinery, at a cost of something like £200,000. This would give them considerable reserve power; but they were not depending entirely on this. They had a contract with the Metropolitan Electric Tramway Co. to supply them with a certain amount of power, and under that contract power was being supplied to them now. They had also a contract with one of the public authorities, and cables were being laid down in order to give them a third string to their bow. They were thus taking every means in their power to meet the difficulties.

Mr. G. H. Hume, vice-chairman, Highways Committee, said none of the three accidents had anything to do with an over-demand on the resources of the generating station. That on March 10th was due to a slight error of judgment. On Monday last a piston was blown out of one of the engines, owing to the breaking of a cotter-pin, and a piece struck a generator. That caused a short-circuit, which in turn caused a short-circuit on the high-tension board. A section of the switchboard caught fire, and the same generator which broke down in March gave way in another place. The whole service had to be stopped while the fire was being put out, and the extent of the damage was being ascertained. It was no use the Council blinking at the fact that they were working with a very small margin at their generating station. After further discussion the matter dropped.

The total traffic receipts of the L.C.C. tramways for the year, April 1st, 1912—March 31st, 1913, were £2,143,190 from electrical lines, and £37,545 from horse tramways. The comparable receipts for the previous year were £2,231,945 and £60,356, showing a decrease of over £111,000.

STEPNEY.—The L.C.C. is to be requested to include in one of its General Powers Bills a clause to empower a Council to recover the cost of damage done to street lamp columns from the owner or owners of the vehicle, instead of from the driver as at present.

Manchester.—At a meeting of the Tramways Committee recently, the estimates for the ensuing year were considered. By resolution of the City Council, and in accordance with the scheme of the Trading Profits Committee, the tramways undertaking is expected to contribute £100,000 to rate relief purposes, being 5 per cent. on a capital expenditure of, roughly, £2,000,000. The estimated receipts for the ensuing year are put at over £900,000. The capital expenditure account makes provision for £30,000 for buildings, £30,000 for permanent way (new lines), £25,000 for street improvements, and £30,000 for cars and equipment.

Nelson.—A record year is reported in connection with the tramways undertaking. The Committee estimated a profit of £450, but this has been exceeded by no less than £1,000. The light railways have carried 267,271 more passengers than in the previous year, notwithstanding the fact that last summer was an abnormally wet one. The most gratifying feature is the great improvement which has taken place in regard to the Scotland Road section, which has hitherto been a great drag on the undertaking.

TELEGRAPH and TELEPHONE NOTES.

Direct Cable to Canada.—Direct telegraphic communication between the United Kingdom and Canada has been opened, on the Morse system of Mr. John Gott.

Rural Telephones.—In answer to a question, the Postmaster-General recently stated that the additional Treasury grant of £20,000 would probably admit of the provision of about 1,300 additional rural party-line telephones.

United States.—It has been announced that a contract for eight wireless telegraph stations, to be the most powerful in the world, has been awarded by the American Marconi Wireless Telegraph Co. to the J. G. White Engineering Corporation. The stations will be located in pairs, a receiving and a sending station being 30 miles apart to reduce interference, at Oahu, H.I.; Tamales Bay and Bolinas, Cal.; near Belmar, N.J., and in Eastern Massachusetts. Later on a station will be established in Japan. The range of these stations is estimated at from 4,000 to 6,000 miles, and each will utilise a different wave-length. The antennæ will be 400 ft. or more high. Each station is to consist of 12 towers arranged in a semicircle covering a square mile. The power available at each station will be 750 KW.—*Electrical Review and Western Electrician.*

Wireless Map of the World.—An admirable map of the world has been compiled by Marconi's Wireless Telegraph Co., Ltd., and is published by Messrs. George Philip & Son, Ltd., at 2s. 6d. net. It shows very clearly the position of all stations open for ship-and-shore communication, high-power public and private stations, the long-distance stations of the Imperial scheme, and other stations for trans-oceanic communication. Lighthouse, lightship and Naval stations are not shown, and this, perhaps, accounts for the omission of the stations at the Eiffel Tower and Nauen, for example, though we were not aware that these were regarded as "Naval." The distribution of the stations over the world is very interesting; Canada is thickly dotted with them along the St. Lawrence and the great lakes, as well as on the West coast. British East Africa, the Gulf of Mexico, and the East coast of South America are also noticeably well equipped, but the greatest concentration is, of course, in the West and South of Europe. The map is very welcome, and certainly fills a distinct want.

(*Continued on page* 647.)

THE ELECTRICITY WORKS OF TROLLHÄTTAN.

The first power station erected by the Swedish Government is the huge undertaking at Trollhättan, which was carried out by the State Waterfalls Board, under the supervision of the manager of the Board, Col. F. V. Hansen, the chief engineers, Mr. T. Holmgren and Capt. G. Malm, and Mr. Holmgren's assistant, Mr. W. Borgqvist. The contractors were the Allmänna Svenska Elektriska Aktiebolaget—the "General Electric Co. of Sweden"—a firm which, founded by Jonas Wenström in the early eighties, has continuously progressed, and has become one of the most capable and successful concerns in Europe. The company recently issued an admirable description of the undertaking, and has kindly provided us with the photographs which we reproduce herewith.

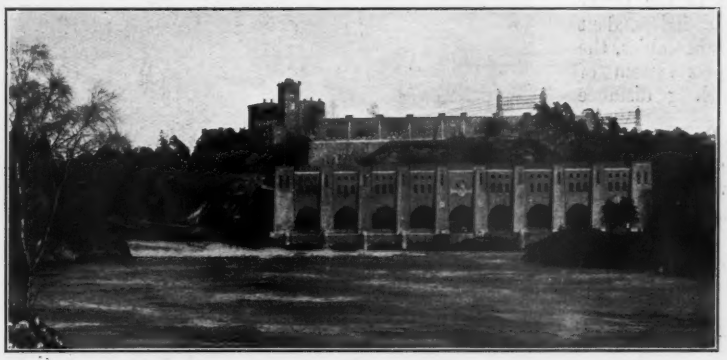


Fig. 1.—Trollhattan Power Station and Switch-House.

The generating station is situated, amidst wild and picturesque scenery, at the Trollhätte Falls on the Göta River, which carries the discharge from Lake Vänern, the largest lake in Sweden, having an area of 5,570 sq. km. The whole of the water-power of this river became the exclusive property of the State in 1908.

The river is 86·5 km. in length, and has a total fall of 44 m., of which 32 m. is available at Trollhätte Falls. The minimum discharge is 320 m.³ per second, and the present works are laid out for a flow of 250 m.³ per second, giving 80,000 H.P.; but by regulating the level of the lake, a total output of 200,000 H.P. can be made available.

From the headworks, the water is carried in a canal, 1,300 m. in length, to the forebay, which we illustrate on page 644, whence it is led by eight steel pipes, 4·25 m. in diameter and 60 m. long, through tunnels blasted out of the solid rock, to the power house. Three smaller pipes in a common tunnel feed the exciter sets. Ice-screens and headgates are provided within the intake building, and the former can be heated with electricity to prevent the formation of frazil. The arrangement of the plant is shown in figs. 3 and 6.

The power station, a building designed in keeping with its rugged surroundings, contains six three-phase generators of 11,000 K.V.A. at 10,000 volts, 25 cycles, directly coupled to horizontal turbines running at 187·5 R.P.M., which utilise

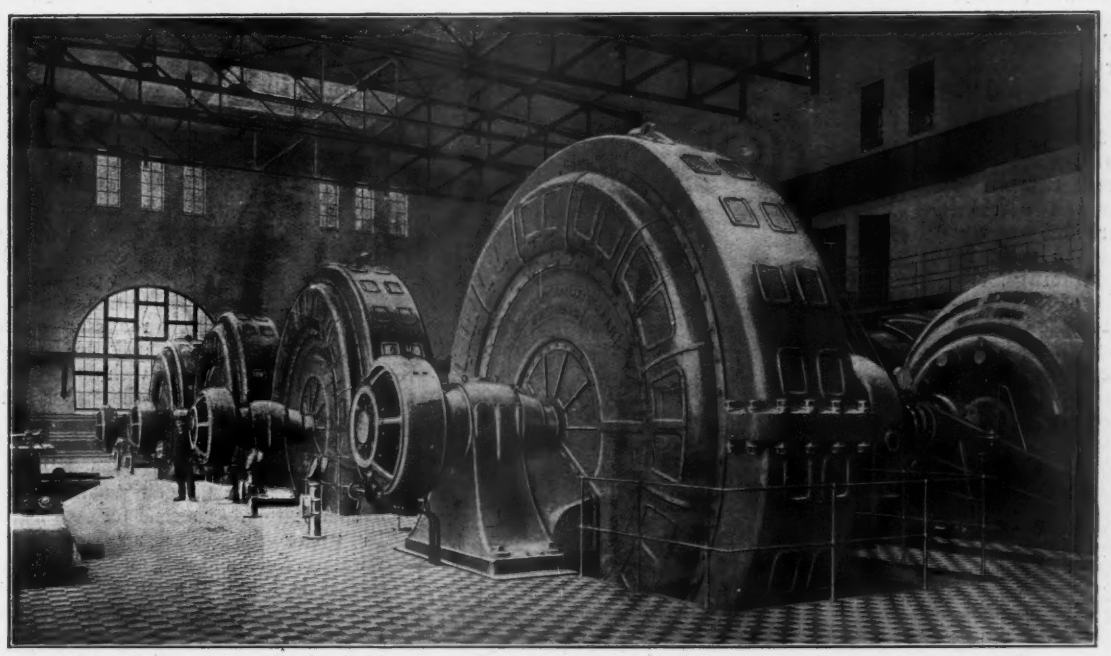


Fig. 2.—Interior of Turbine Room.

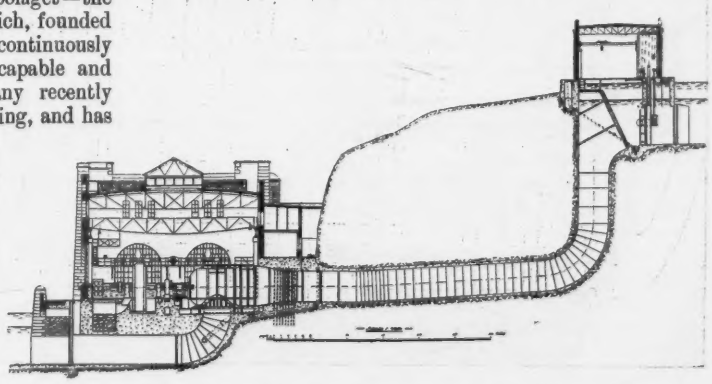


Fig. 3.—Section of Power Station and Sluice Gates, Trollhattan.

an effective head of 30 m. Each turbine consists of two wheels enclosed in a common steel casing, and is provided with automatic regulating apparatus. Eventually the station will contain eight generating sets, in addition to the three exciting sets, of 350 KW. each at 220 volts. A storage battery is used in conjunction with the exciters. The switchgear is housed in a separate building, connected with the works by a cable tunnel 200 m. in length, there being no room for the switch-house close to the power station. The tunnel is divided into four independent corridors, and carries, in addition to the main cables, the signalling and operating lines for the complex system of remote control rendered necessary by the long distance between the two buildings.

In the switch-house are cells for eight groups of transformers, of the oil-insulated water-cooled type, which step up the pressure of part of the supply to 50,000 volts, for transmission to the more remote centres of utilisation.

The alternators have an efficiency of 96 per cent. when giving 9,000 KW. with a power factor of 0·8, and 96·9 when giving 7,200 KW. at unity power factor. The rise of pressure when the full load is switched off is 21 per cent. The mode of excitation is unusual; the three exciters work at 220 volts, and each of the alternators has on the end of the shaft an exciting booster, which is connected in series with the field winding and the main exciter busbars, and gives a pressure varying from + 110 to — 220 volts. Thus the resultant pressure of the exciting current can be varied between 0 and 330 volts, by regulating the field of the separately excited boosters. One of the alternators is provided with damping coils on the poles, to enable it to run as a single-phase generator for traction, the future supply of the State railways being one of the purposes for which the works have been built. The stator can be moved axially sideways, to enable the coils to be easily got at for inspection or replacement, the winding being laid in open slots.

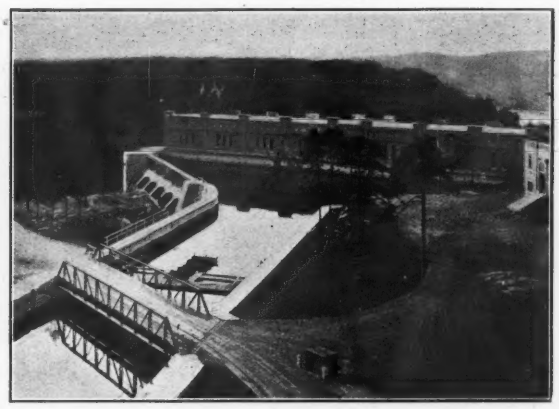


FIG. 4.—POWER CANAL AND FOREBAY, TROLLHATTAN.

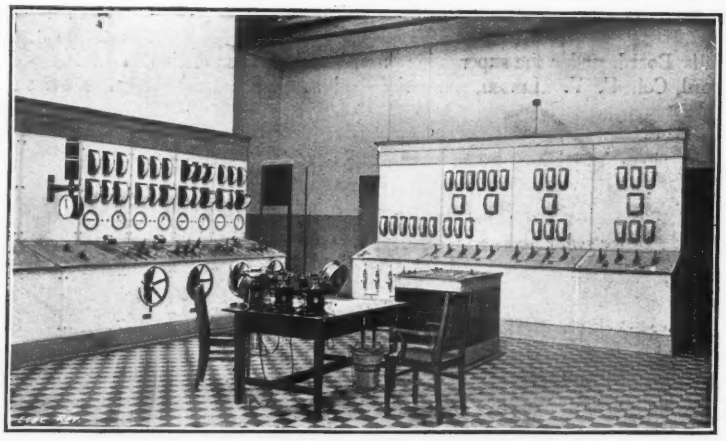


FIG. 5.—INTERIOR OF SWITCH-ROOM.

A noteworthy feature of the generators is the system of ventilation employed. As will be seen in the illustration, fig. 2, the rotors are enclosed, and are provided with ducts bringing air from the outside of the power station, the rotors carrying fans to propel the air, which passes through the stator and is carried away to outlets in the walls of the building. The cooling air required amounts to about 20 m^3. per second for each machine. In winter the heated air is useful for warming the buildings, and in summer the station is kept cool; an additional advantage is that the machines are absolutely noiseless. The generators can be run as open machines by taking off the central end shields. The stators are of considerable size, measuring 6·65 m. in height from the base, and 4·9 m. from the ground level; the rotor is 4·75 m. in diameter. Each generator weighs about 200 tons, the rotor alone weighing 67 tons. In these days of high-speed turbines, the majestic dimensions of the machines of ten years ago are seldom met with; fig. 2 will give a fair impression of the massive proportions of these fine alternators.

The storage battery has a capacity of 1,000 KW.-hours, or 4,800 amp.-hours at the three-hour rate of discharge.

In the switch-room there are two control-boards of the bench type, for the generators, and for the transformers and feeders respectively. These are shown in fig. 5, with the signal desk provided with telephones and engine-room telegraphs communicating with the power station.

(To be concluded.)

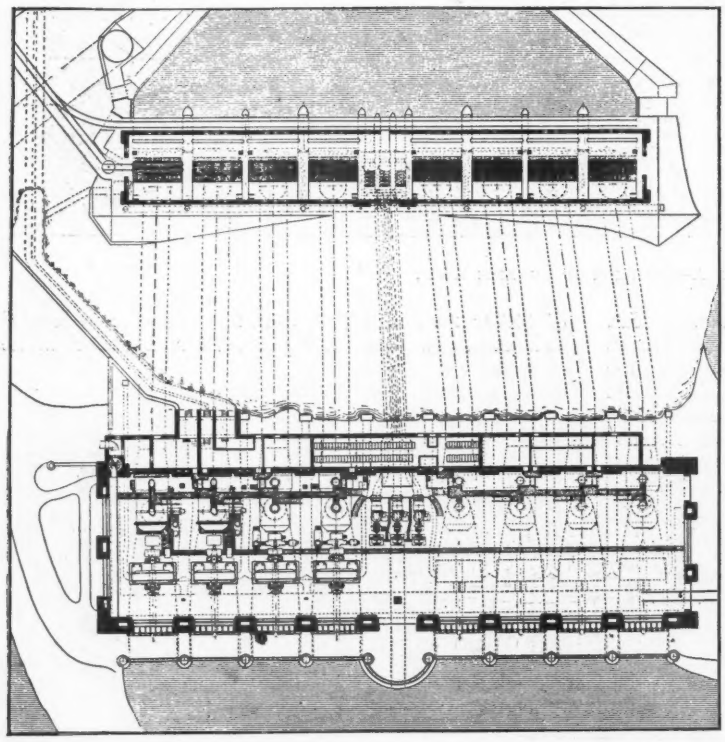


FIG. 6.—PLAN OF POWER STATION AND FOREBAY, TROLLHATTAN.

SOME AMERICAN CEMENT MILL INSTALLATIONS.

As many of our readers are aware, the conditions of service under which electrical motors in cement works are called upon to work, are extremely severe; the atmosphere is heavily charged with dust, and the attention given to the electrical plant is often quite unskilled in character. Yet both in this country and abroad, the electrical drive is now regarded as an indispensable feature of the modern cement mill, and as cement machinery largely runs throughout the day and night, it obviously provides an excellent load factor for electrical generating plant. For work of this description, the A.C. squirrel-cage induction motor is generally considered the best for well-known reasons, and our views illustrate some typical applications of these machines in large American cement works.

Fig. 1 shows two 440-volt 40-H.P. squirrel-cage motors, speed 166 R.P.M., driving ball mills in a raw-material mill of the Universal Portland Cement Co.

The ball mill consists of a heavy cylindrical drum containing heavy steel balls, which grind the material fed in as the drum slowly rotates; the drum speed is only about 20 R.P.M., and two-gear reductions are often adopted, but where a 25-cycle supply is available, good results are obtainable by using a slow-speed induction motor, as shown, with only one gear reduction.

In the works referred to, there are nine of these mills so driven.

Figs. 2 and 7, show Fuller mills driven by vertical type squirrel-cage motors; in these mills the centrifugal pressure of large steel balls against a heavy steel ring pulverises the material, which is driven out by a fan through a screen which surrounds the chamber immediately above the steel ring. The Fuller mill is sometimes driven by ordinary type motors by means of quarter turn belts, an arrangement which, on account of the belt wear, is not so good as that shown and almost always used. The first view shows four of eight 40-H.P., 500 R.P.M., 440-volt S.C. motors driving Fuller mills at the Universal Cement Co.'s works, and the second 10 550-volt, 25-cycle, 75-H.P. S.C. motors, speed 500 R.P.M., in similar use at the Tidewater Portland Cement Co.'s works.

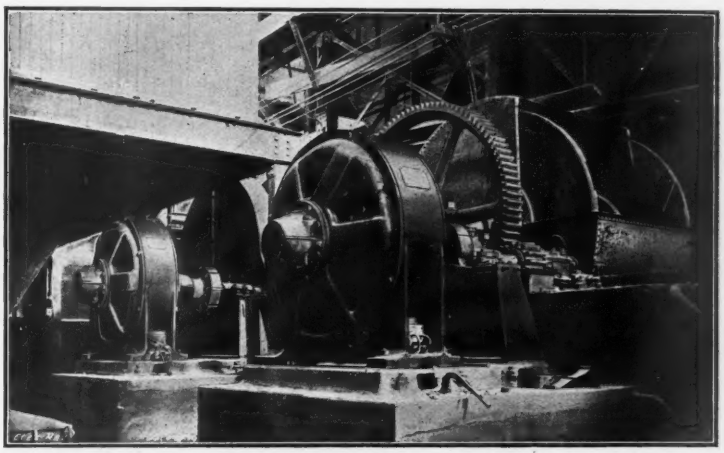


Fig. 1.—Two 40-H.P. Squirrel-Cage Motors Driving Ball Mills.

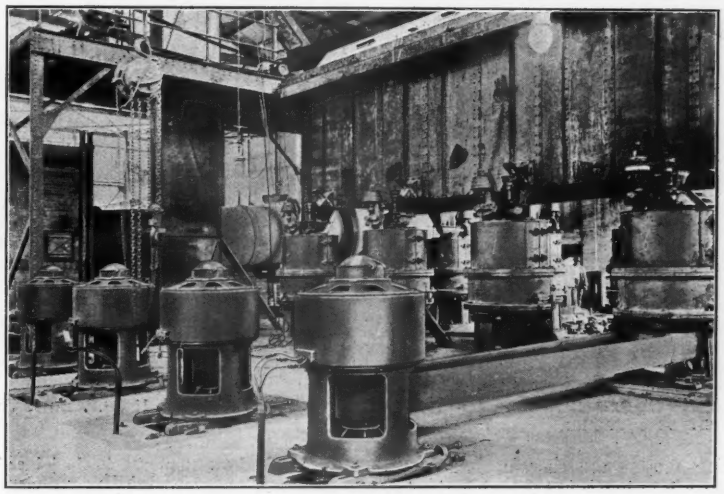


Fig. 2.—Vertical Motors Driving Fuller Mills; Universal Portland Cement Co.

Our illustrations, figs. 3 and 5, show squirrel-cage induction motors driving tube mills through gearing.

As will be seen in the first illustration, fig. 3, of 12 440-volt 100-H.P. machines, speed 166 R.P.M., driving raw material tube mills, through flexible couplings and countershafts on the mills, at the Universal Portland Cement Co.'s works, the motors are installed in a separate room ensuring much cleaner operating conditions than would otherwise be obtained. Fig. 5—a view in the Sandusky Cement Co.'s works, where six 85-H.P. 375 R.P.M. motors driving tube mills are in use—gives a better idea of the flexible coupling and ordinary operating conditions where tube mills are driven. The tube mill, it may be mentioned, is one of the most extensively employed in various industries where a fine product is required; it consists only of a horizontal rotating steel cylinder lined with hard cast-iron plates and about half filled with flint pebbles.

The modern rotary kiln, which will be familiar to our readers, is used for burning the raw material to clinker, the

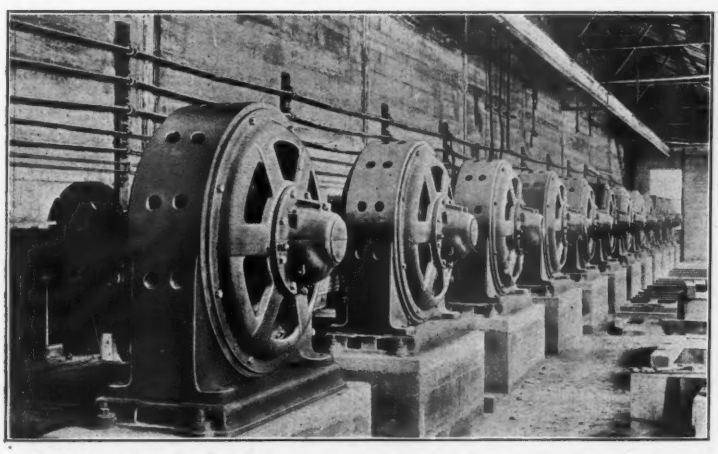


Fig. 3.—Twelve 100-H.P. Motors Driving Tube Mills.

flame travelling up the kiln in the opposite direction to the material. Such kilns are driven through both belt and gear

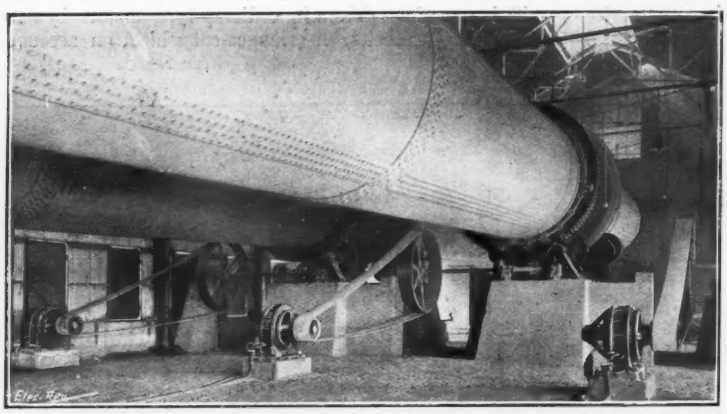


Fig 4.—75-h.p. Motors Driving Rotary Kilns.

drives, although the former type of drive is preferable, as it is possible to place the motor at a greater distance from the hot kiln. In order to regulate the time during which the material is subjected to flame, the speed of rotation requires to be varied, and slip-ring motors are therefore employed. Fig. 4 gives a good idea of a kiln house at the Knickerbocker Cement Co.'s Works, three 75-h.p. 440-volt slip-ring induction motors, speed 720 r.p.m., being shown with belt-drives on to countershafts, and gear-drives from the latter to the kilns.

The kilns are fired by means of powdered coal, and motor-driven fans are employed for forcing the latter, with the necessary air, into the kilns, as also into the slag and limestone dryers.

Our illustration fig. 6 shows a 150-h.p. s.c. motor running at 750 r.p.m. and driving a gyratory rock crusher used in the preliminary rock crushing operations; it is usually belt-driven, as in the event of the crusher becoming clogged with rock, a gear drive would be subjected to severe strains. The view was taken in the Tidewater Cement Co.'s works.

The subject of electricity in Portland cement works was dealt with fully in our issues on January 20th and 27th, 1911, particularly as regards the probable power requirements.

We are indebted to the British Thomson-Houston Co. for the illustrations here given; this company, through their associations and connections, have electrically equipped over 50 cement works throughout the world, including those referred to above.

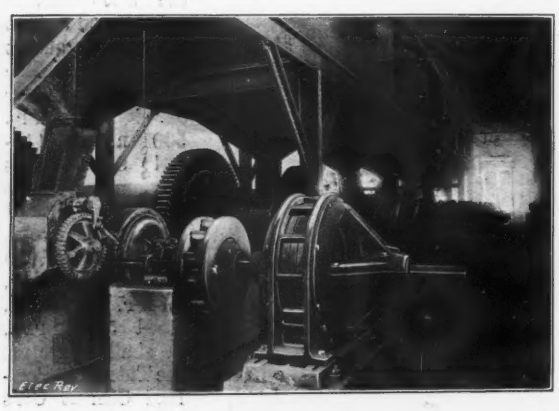


Fig. 5.—Tube Mill Drive, Sandusky Works, Showing Flexible Coupling.

Fig. 6.—A 150-h.p. Rock Crusher Drive.

Fig. 7.—Group of Ten 75-h.p. Vertical Motors Driving Fuller Mills

Leeds Rifle Club. — In connection with a shooting competition recently arranged by the Leeds Municipal Officers' Rifle Club, the prizes were given by Mr. W. T. Green, of the Electricity Department, Leeds, and consisted of a silver-mounted Wedgwood mug (first prize), an S.M.R.C. silver spoon (second spoon), and there was also a third money prize.

A Canadian Electrical Farming Plant.—A recent issue of the *Electrical News* describes a small hydro-electric plant in use on an Ontario farm. A flour mill was being run by water power and another 10-h.p. wheel driving a 5-h.p. 110-volt dynamo was added, the wheel running at 800 r.p.m., under a 42-ft. head. No governor is provided, the load, as judged by the mill lights, being regulated by the water. Electric light is used in the mill, barns, office, stables, dairy and residence—40 16-c.p. and some 25-c.p. tungsten lamps being employed, usually half at one time. In addition to the lighting, a motor is installed for driving the separator, pasteurizer, churn and milking machine; a motor-driven saw and emery wheel are employed in the joiners' shop and a motor-driven vacuum pump is installed both for cleaning purposes and for use in connection with the milking machine. Arrangements are being made to run a laundry electrically—the ironing, water heating, &c., being already accomplished by electrical methods.

TELEGRAPH and TELEPHONE NOTES.

(*Continued from page* 642.)

Brazil.—The Government has authorised the erection of two wireless telegraph stations, one being at Fortaleza, in the State of Ceara, and the other at Porto Murtinho, in Matto Grosso. The cost is to be £26,800. Also a special telegraph line is to be erected between Rio de Janeiro and the State of St. Paul, the cost of construction being estimated at £28,000.

Imperial Wireless System.—At the resumption of the inquiry into the Marconi agreement by the Select Committee on Wednesday last week, Mr. W. G. Rice, the stockbroker who acted for Mr. Lloyd George, was examined, and said that on April 19th, 1912, he warned Mr. George that the American Marconi shares were not a desirable investment. On May 22nd he purchased 3,000 of the shares for Mr. George. Mr. Percy Heybourn, who dealt in American Marconis, also gave evidence with regard to 350,000 of the shares, which he had from Mr. Godfrey Isaacs. The witness declined to give particulars as to the number and price of shares that he sold before April 19th. On the following day Mr. Heybourn was further examined, but owing to a resolution of the majority of the Committee, a question as to the number of shares sold before April 19th was disallowed, and the minority protested. The witness's refusal to answer other questions was supported by the chairman.

The next witness was Mr. Godfrey Isaacs, who gave evidence regarding the arrangements made between the British and American companies. As the new capital required to purchase the United Wireless Co.'s assets, and to carry out new work, could not be raised in America, the British company agreed to take up 900,000 shares, on condition that Mr. Isaacs made himself responsible for a further 500,000, the total amount being £1,400,000. He gave particulars of the subsequent placing of the shares on the market, and stated that all the profit on the shares had gone to the British company, he himself having made no profit, though he was entitled to do so. He had heard in April that a strong attack was to be made on the Marconi contract with the Government, and that there was a syndicate which was promoting the Poulsen company, with the support of members of Parliament. A prospectus of the Poulsen system dated March 5th, 1912, which he received, bore only the names of Mr. A. A. Campbell Swinton, attached to a report on the system, and of the printer. Mr. Swinton was recommended by Sir Henry Norman as an expert qualified to advise the Committee as to the best system for the Government to adopt. He could not obtain any information as to the source of the prospectus. He heard in July that those connected with the syndicate were arranging an attack upon Ministers to prevent the ratification of the contract.

On Monday Mr. Isaacs was further examined with regard to his evidence-in-chief, and stated that he had been informed from many sources that Major Archer-Shee, M.P., and Mr. Norton-Griffiths, M.P., were concerned in the agitation. It being pointed out that the Committee knew that Mr. Swinton had reported on the Poulsen system, long before Sir Henry Norman mentioned his name, Mr. Isaacs stated that he was not aware of the fact. The net result of the arrangement with the American Co. was that the English Co. had rights to about 1,200,000 shares out of a total share capital of 2,000,000. He offered the American shares to his brothers because he thought the American Co. had the best prospect of all the wireless companies. In 1909 the English Co. was badly in want of capital; it had a substantial business and a large organisation, but no liquid capital. The number of American shares now held by the English Co. was 566,700.

After discussing the fluctuations in the price of the English Co.'s shares, Mr. Isaacs stated that not only the contract with the Norwegian Government, but practically every important undertaking in the world that he had been negotiating for the last two years was standing over, in consequence of the contract with the British Government. The English Co. had resold practically the whole of the assets of the United Wireless Co. to the American Co.

The Committee sat again on Wednesday.

On Monday, Major Archer-Shee and Mr. Norton-Griffiths both published statements that they had no financial interest in the Poulsen Syndicate.

Wireless Telephony.—At Dinnington Main colliery, in the South Yorkshire coal area, interesting experiments are being conducted with wireless telephony. An installation is being fitted up in the pit and on the surface, and it is claimed that the system, invented by a German scientist, makes it possible to converse through 1,500 yards of solid rock.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices", April 11th.

Victoria.—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

April 29th.—20,000 yd. of 3-in. fibre conduit, for the Melbourne City Council. See "Official Notices" April 11th.

Sydney.—May 12th. Fibre conduit for the City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 10s. 6d. for each section, from City Electrical Engineer's Department.—*Australian Mining Standard.*

Tasmania.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

Queensland.—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" April 11th.

Austria.—Vienna.—May 13th. Supply of 1,800 intercalary switches for the central-battery system. Particulars, Postökonomieverwaltung, Vienna.

Bedford.—April 23rd. Carbon and metallic-filament incandescent lamps, for a year, for the Corporation. See "Official Notices" April 11th.

Belgium.—May 3rd. The Belgian Government, Salle de la Madeleine, Brussels. Supply and erection at the Royal Palace at Laeken, of two rotary transformers.

Canada.—Winnipeg.—May 15th. City Light and Power Department. Two three-phase generators of 5,000 kw. for direct connection to 6,800-h.p. water turbines; also spare parts. Chairman, Board of Control. Deposit, £205. Particulars, Board of Trade Com. Intel. Department in London.

Cheltenham.—The T.C. has instructed the borough electrical engineer to obtain tenders for additional condensing plant.

Dublin.—April 24th. High-tension and low-tension switchgear, cables and accessories, for the Corporation. See "Official Notices" April 11th.

May 1st.—E.H.P. sub-station switchboard and accessories and alteration to existing E.H.P. switchboard, for the Corporation. See "Official Notices" to-day.

Felixstowe and Walton.—May 5th. One 150-kw. Diesel-driven D.C. generating set for the U.D.C. See "Official Notices" to-day.

Germany.—The Hamburg Finance Deputation is at present in the market for the supply of four electric cranes.

April 24th.—The Lighting Committee of the Municipal Council of Bremen is inviting tenders for the supply and erection of two transformers at the central electric lighting station.

Hoylake and West Kirby.—May 5th. One 400-kw. alternator and triple-expansion Belliss engine, and evaporative condensing plant, for the U.D.C. See "Official Notices" to-day.

Hull.—April 23rd. Electric light at Stepney Lane and Cleveland Street workshops and stables, for the T.C. Mr. A. E. White, City Engineer, Guildhall.

April 24th.—Electric light installation and fittings, Saner Street School, for the T.C. Mr. J. H. Hirst, City Architect, Guildhall.

King's Lynn.—May 5th. One 4,000-kw. steam dynamo with condensing plant and pipework, for the Corporation. See "Official Notices" to-day.

Liverpool.—April 18th. Electric light and power installation at the Highfield Infirmary, Knotty Ash, for the Select Vestry. See "Official Notices" April 11th.

London.—L.C.C.—April 23rd. Electrical installation at Shadwell High Street Special School. See "Official Notices" April 4th.

Fulham.—April 23rd. 6,000 tons of nutty slack coal, for the B.C. Electricity Works. See "Official Notices" April 4th.

Southwark.—April 23rd. Two boilers, with fan, economiser and conveyors, two 1,500-kw. generators, four converters, switchboard, barometric condenser, cooling tower and steel structure, for the B.C. See "Official Notices" April 11th.

Metropolitan Asylums Board.—April 23rd. Electric light installation in the Laundry Block and Block No. 12 at the Grove Fever Hospital, Tooting Graveney. See "Official Notices" April 11th.

Royal Mint.—April 25th. 120 tons of ingot copper. See "Official Notices" to-day.

Manchester.—April 23rd. E.H.T. switchgear, low-pressure steam and water pipes, hot-well, valves, &c., and two 50-h.p. three-phase motors for cooling towers, for the Corporation. See "Official Notices" April 11th.

Newcastle-on-Tyne.—April 23rd. E.H.T. three-phase lead-covered paper cable and single conductor L.T. lead-covered paper cable, for the Corporation Tramways Committee. See "Official Notices" April 11th.

Newport.—April 26th. One 2,000-2,500-kw. steam turbo-alternator, surface condensing plant, one 600-kw. D.C. generator, and E.H.T. and L.T. switchgear, for the Corporation. See "Official Notices" April 11th.

Rochdale.—April 24th. Tramways Committee. Stores and materials for a year. Mr. J. S. D. Moffet, Tramway Offices, Mellor Street.

Rotherham.—April 19th. Three motor-omnibuses, complete and ready for use, for the T.C. The Tramways Manager.

Salford.—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. General Manager, 32, Blackfriars Street, Salford.

Sheffield.—May 5th. Excavations, retaining walls and extension to water service reservoir at Neepsend Power Station, including valves, pipework, &c., for the Corporation. See "Official Notices" to-day.

South Africa.—DURBAN.—May 28th. Electric meter-testing equipment, for the Council. Copy of specification, &c., may be seen at Board of Trade Com. Intel. Dept. in London.

South Shields.—May 1st. Tramway stores for one or three years, for the T.C. Mr. W. T. Robson, manager, Dean Road.

Spain.—BARCELONA.—Tenders are requested for a concession for the installation and working of an electric tramway within the precincts of Barcelona. Deposit, 4,197·55 pesetas. Particulars, Ministerio de Fomento, Madrid.

MADRID.—May 21st. Tenders are invited for the construction of a strategic railway from Verin to Sanabria, worked by steam or electricity. Local representation indispensable. Particulars from the Ministerio de Fomento, Madrid.

Venezuela.—The municipal authorities of Ocumare del Tuy are at present inviting tenders for the concession for the electric lighting of the town.

Warrington.—April 29th. Two steel frames, for the Electricity and Tramways Committee. Mr. F. V. L. Mathias, Borough Electrical and Tramways Manager, Howley, Warrington.

CLOSED.

Australia.—Our contemporary *Tenders* (*M. and E. Review*) reports that the Sydney Council received the following tenders for flame arc lamps :—

Union Electric Co. of Australia, Ltd.		£656
.. .. ..	(alternative)	725
Australian Metal Co., Ltd.		753
Falkner-Boll Electric Machine Co.		813
N. Guthridge, Ltd.		946

The Sydney Council has also received the following tenders for a 5,000-KW. motor-generator :—

Noyes Bros. (Sydney), Ltd.—£23,310.
Australian Metal Co., Ltd.—Formal tender, £21,233; alternative No. 1, £20,563; alternative No. 2, £18,521; alternative No. 3, £17,861.
Dick, Kerr & Co., Ltd.—Formal tender, £23,495.
Wm. Adams & Co., Ltd.—Formal tender, £27,661; alternative, £26,589.
Australian General Electric Co.—Formal tender, £26,871; alternative No. 1, £24,158; alternative No. 2, £28,101.
Haes & Eggers. Ltd.—Formal tender, £23,650.
Siemens Bros. Dynamo Works, Ltd.—No formal tender; alternative No. 1, £8,640.
Belliss & Morcom, Ltd. (agents, Messrs. Price, Martyn & Co.).—Formal tender, £24,100, exclusive of duty.

The same exchange states that the Provincial Electric Development Co. has accepted the tender of the Silverton Telegraph Works Co., Ltd., Melbourne, for the installation of electricity in Shepparton (Vic.). The plant will include a Hornsby suction gas engine.

The Corowa Shire Council (N.S.W.) has accepted the tender of the Australian Metal Co. for electrical plant in connection with the lighting system to be installed.

The Home Affairs Department, Victoria, has placed a large order for tubular iron poles with Messrs. Siemens Bros., and one for copper wire, 300 lb. per mile, 124 tons, at £98 7s. 6d. per ton with Messrs. Johnson, Clapham & Morris. Messrs. Siemens will also supply 46,000 porcelain insulators, and 161 tons of copper wire, at £98 10s. per ton.

For the Maffra (Vic.) Shire Council the following plant, &c., has been ordered :—

Two 37-KW. generators, £557; switchboard, £220; battery, 180-cell, £600; erection of poles, £879.—Siemens Bros. Dynamo Works, Ltd.
Poles, £378.—Chas. Dennis, Jun.
Cables, £795.—B.I. & Helsby Cables, Ltd.
Power house, £628.—W. Dennett.
Suction gas plant, £2,070.—R. Hornsby & Sons.

According to the *Australian Mining Standard*, the following orders have been placed by the Postmaster-General's Department :—

HOBART.

46 chains cable, 260 pairs, £425:—B.I. & Helsby Cables, Ltd.
118 chains cable, 208 pairs, £835; 54 chains cable, 156 pairs, £311.—Australian Metal Co., Ltd.

GENERAL.

Ten Tudor accumulator batteries, unburnt, £255 each.—Tudor Accumulator Co., Ltd. (London).
One 15/17½-B.H.P. vertical marine oil engine, with D.C. generator set, delivery, £900; 10 generating plants, each comprising a 15/17½-B.H.P. two-cylinder vertical marine oil engine, with D.C. generator set, for Fremantle, Darwin, Cooktown and Rockhampton, £3,079.—The Maritime Wireless Co. (Shaw System), Ltd., Randwick, N.S.W.

Balmoral.—In connection with the electric light and organ-blowing installation at the Craithie Church, Messrs. Stanley Roy & Co., of Edinburgh, are supplying the Lister-Bruston system.

Barrow-in-Furness.—The T.C. has accepted the tender of the Reason Manufacturing Co., Ltd., for miniature type electrolytic meters for the ensuing year.

Bexhill.—The Council has accepted the tender of Messrs. Crompton & Co., Ltd., at £330, for a switchboard for the electricity works.

Bolton.—After considering a letter from Mr. W. Gornall referring to his tender for chimney stacks at the new generating station, the Electricity Committee rescinded the resolution passed on March 27th accepting his tender for the erection of two chimney shafts. The tender of Mr. S. Pearce was accepted. The tender of the Chloride Electrical Storage Co. for storage battery was accepted; also that of Messrs. Royce, Ltd., for an overhead travelling crane.

Bournemouth.—The T.C. has arranged with the Post Office to provide, fix and maintain fire-alarm telephones, 18 circuits to be connected, at £126 per annum.

Bradford.—The new spinning mill and weaving shed of Messrs. G. A. White & Co., of Dumb Mills, Frizinghall, are to be supplied with a complete electrical installation, both power and lighting, and the order for the work has been placed in the hands of the A.E.G. Electric Co., Ltd., Leeds.

Croydon.—The E.L. Committee has accepted, for the ensuing year, the tender of the Reason Manufacturing Co., Ltd., for electrolytic meters up to 10 amperes for use on D.C. circuits.

Egypt.—The following tenders were received for the Damietta installation; in the specification for the station plant three Diesel engines were called for which were to be capable of being started on petrol :—

FOR BOTH SECTIONS.

Ganz & Co.	highest	£E17,590
Various alternative offers	lowest	16,250
Compagnie Egyptienne Thomson-Houston ..	highest	18,230
Various alternative offers	lowest	16,123
Siemens Schukert	highest	16,060
Various alternative offers	lowest	14,380
Naham, one offer		16,073

FOR SECTION 1 ONLY.

Sayer & Colley	£E10,732·721
Egyptian Engineering Stores	9,660
Egyptian Engineering Co.	8,730·600
Nahman & Co.	8,286

(Egyptian pound = £1 0s. 6d.)

Glasgow.—A number of tenders have been accepted by the T.C.'s electricity department. These include :—

40-ton overhead travelling crane for Port Dundas station.—John Grieve and Co., £1,389.
Alterations in ash-conveying plant at St. Andrew's Cross station.—Babcock and Wilcox, Ltd., £1,595.
Motor for same.—B.T.H. Co., Ltd., £218.
Feed pump for Port Dundas station.—J. & P. Hall, £272.
Coal conveyor for Partick works.—Babcock & Wilcox, Ltd., £390.

Halifax.—The Council has placed a contract with Messrs. Chamberlain & Hookham for meters.

Immingham Docks.—Messrs. Johnson & Phillips, Ltd., who early last year supplied an installation of 200 "Metroflam" magazine flame arc lamps for the Great Central Railway's new docks at Immingham, have now in hand a repeat order for 111 similar lamps, the company having decided to extend the "Metroflam" lighting at Immingham and Grimsby. A large number of these lamps are also being supplied to the Barry Railway Co. for their coal-loading staithes at Barry, and to the Tyne Improvement Commission for the lighting of the docks on that river.

Lincoln.—The T.C. has accepted the tender of Messrs. Whipp & Bourne for a switchboard for the electricity works.

London.—L.C.C.—The Highways Committee received the following tenders for static transformers required for the Shoreditch sub-station :—

Johnson & Phillips, Ltd.		£3,346
British Electric Transformer Co.. Ltd.	(recommended)	4,380
British Westinghouse, &c., Co., Ltd.		4,497
Brush Electrical Engineering Co., Ltd.		5,425

Chief Officer's estimate, £4,000.

For foundry crucibles and furnace linings for use in the tramways department, the tender of the Morgan Crucible Co., Ltd., at £71, was accepted; also that of Messrs. Bullers, Ltd., for 2,200 track insulators, at 3s. 7½d. each, and that of Messrs. Doulton & Co., for 3,200 porcelain insulators, at 9d. each.

MARYLEBONE.—Through a blunder on the part of a News Agency we published under Marylebone last week a list of tenders which had been accepted by the Wimbledon Council. The Marylebone contract for meters (Chamberlain & Hookham) is held by Messrs. Venner & Co. for some time to come. Messrs. Ferranti's tender for ordinary P.P. meters was, we understand, for Wimbledon.

STEPNEY.—The B.C. Electricity Committee received the following tenders for four water-tube boilers, with chimneys, economisers and other accessories :—

		With chain grate stokers.	With travelling grate stokers.
Howden Boiler Co.	(recommended)	£34,120	£35,700
Babcock & Wilcox		35,200	36,810
Clarke, Chapman & Co.		37,642	39,160

For two valves required for Limehouse station for use in connection with the River wells, the tenders received were :—

Blakeborough, J., & Sons	(accepted)	£60 per valve.
Alley & MacLellan	70	" "
Glenfield & Kennedy	80	" "

POPLAR.—The tender of the Western Electric Co., Ltd., has been accepted by the B.C., at £2,785, for the supply of 5,000 yd. of ·15-in three-core 6,000-7,000-volt E.H.T. cable, subject to a variation of £2 18s. 3d. per 1,000 yd. for every 20s. rise or fall in price of copper, and £2 10s. 3d. per 1,000 yd. for every 10s. rise or fall in price of lead. Other tenders were received from Siemens Bros. and Co., Ltd., at £2,820; B.I. and Helsby Cables, Ltd., £2,830; and

W. T. Henley's Telegraph Works Co., Ltd., £2,850. The tender of Caird & Rayner has also been accepted, at £61, for the supply of a surface water-heater.

St. Pancras.—The B.C. has received the following tenders for the supply of 215,000 pairs of open type arc lamp carbons :—

Geipel & Co.	£662
Sloan Electrical Co., Ltd. .. .. (accepted)	674
London Electric Warehouse Co.	786
Crompton & Co., Ltd.	749
Ship Carbon Co., Ltd.	759
J. & H. Grevener	786
The Electrical Co., Ltd.	830
General Electric Co., Ltd.	831
Braulik & Co.	867
Electrical Engineering Co., Ltd.	911
Siemens Bros. & Co., Ltd.	1,071

The tenders of the General Electric Co., Ltd., at £43, Geipel and Co., at £25, Sloan Electrical Co., Ltd., at £39, and the Union Electric Co., Ltd., at £105, have been accepted for a supply of flame arc lamp carbons; as has also the tender of the British Electric Transformer Co., Ltd., at £118, for a transformer for testing purposes.

Manchester.—The Electricity Committee has accepted the following tenders :—

Callender's Cable and Construction Co., Ltd.—For 12 months' requirements of low-tension distribution cables.
Liverpool Electric Cable Co., Ltd.—For rubber-insulated cable.
Electrical Engineering and Equipment Co., Ltd.—For paper-insulated cable.
B.I. and Helsby Cables, Ltd.—For the purchase of scrap cable.

The Tramways Committee has accepted the tender of the Daimler Co., Ltd., for four motor-omnibuses, and that of Messrs. Bell Bros. for one motor-car.

Morocco.—With reference to the call for tenders for insulators and brackets for the Moroccan Post and Telegraph Service, it is notified by the Acting British Consul-General at Tangier, that the contract has been awarded, for the sum of 12,750 fr. (£510), to a French citizen in that city.—*Board of Trade Journal.*

Neasden.—Messrs. E. Bennis & Co., Ltd., have received a repeat order from the Metropolitan Railway Co., for their Neasden power station, to relink 36 grates with their Bennis-Miller-Bennett link, including change speed continuous driving gear. This contract follows an initial order for four sets, bringing the number supplied to this station to 40. The Bennis link which is being substituted for those of another make hitherto in use, is specially adapted for slack coals and can now be applied to any existing chain grate frames. The link is particularly valuable where it is essential to burn slack or rough small as well as better class coals, inasmuch as it is so constructed that it is not liable to burn off.

New Zealand.—The contract for switchboard for the Auckland Harbour Board, which was noted for some time in the Review, has been let to Messrs. Turnbull & Jones.

Plymouth.—The contract with the British Electric Transformer Co. has been renewed for a year at the same prices, plus 5 per cent. on account of increased cost of materials. The existing contract with the B.I. and Helsby Cables, Ltd., has also been extended to March, 1914.

Southampton.—The T.C. has accepted tenders for annual supplies of cable from the following :—

Vulcanised bitumen.—W. Rickard, Ltd.; Craigpark Electric Cable Co., Ltd.; and B.I. and Helsby Cables, Ltd.
Paper lead concentric.—Union Cable Co., Ltd.

Southend-on-Sea.—A two years' contract for demand limiters has been placed with Venner Time Switches, Ltd.

Swindon.—The tender of the Electrical Apparatus Co., Ltd., for the supply of 3-amp. meters for 220 and 440 volts, has been accepted by the Council.

Walsall.—The T.C. has accepted the tender of Messrs. E. Green & Son, at £495, for thoroughly overhauling No. 1 economiser and carrying out certain renewals.

The following tenders have also been accepted :—

Babcock & Wilcox, Ltd.—Water-tube boiler, superheater, mechanical stoker, economiser, &c., for the generating station, £3,231.
Pearson, Huggins & Co., Ltd.—Tunics, trousers, overcoats and caps for the tramway employés for the ensuing two years.
L. Andrew & Co.—Oilskins and macintoshes.

West Hartlepool.—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for the supply of 2½ and 5-amp. meters.

Wolverhampton.—A renewal order from the Wolverhampton Corporation Tramways, for traction type tantalum lamps for the ensuing 12 months, has been received by Messrs. Siemens Bros. Dynamo Works, Ltd.

York.—The T.C. on Monday accepted the following tenders :—

Babcock & Wilcox, Ltd.—Two water-tube boilers, with superheaters, chain-grate stokers, pipework, &c., £4,213.
Oerlikon & Co., Zurich.—Turbo-alternator, 3,000 B.P.M., condensing plant, &c., £9,967.
Tudor Accumulator Co., Ltd.—Storage battery and reversible booster, &c., £3,899, and £188 per annum for 15 years for maintenance.

Yorkshire.—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained two further contracts for the supply of tantalum traction lamps for two of the largest Corporation tramways in Yorkshire. They have also received a contract for the supply of Wotan lamps for shed and general tramway lighting other than cars.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, April 18th. At 8 p.m. Address by the President.

Royal Institution.—Friday, April 18th. At 9 p.m. Discourse on "Applications of Polarised Light," by Dr. T. M. Lowry.

Junior Institution of Engineers.—Friday, April 18th. At 8 p.m. At 39, Victoria street, S.W. Paper on "Crude-Oil Engines," by Mr. W. A. Tookey.
Friday, April 25th. At 8 p.m. At 39, Victoria Street. Paper on "Condensing Machinery," by Mr. J. Elliott.

Institution of Post Office Electrical Engineers.—Monday, April 21st. At 5 p.m. At the I.E.E. Annual general meeting.

The 25 Club.—Wednesday, April 23rd. At 7.15 for 7.30 p.m. At the Connaught Rooms, Gt. Queen Street, W.C. Dinner.

Association of Electrical Station Engineers (London Section).—Thursday, April 24th. Meeting at 7 p.m. At Salisbury House, E.C.

Institution of Electrical Engineers (London).—Thursday, April 24th. At 8 p.m. Paper on "Phase Advancing," by Dr. G. Kapp.
(Yorkshire Section).—Wednesday, April 23rd. Meeting at 7 p.m. At the University, Sheffield.
(Newcastle Section).—Monday, April 21st. Meeting at the Armstrong College, Newcastle.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, April 21st.—"A" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Tuesday, April 22nd.—"B" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Thursday, April 24th.—"C" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Friday, April 25th.—"D" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Saturday, April 26th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. Campbell, Capt. R.E., and Adjt.
For Officer commanding L.E.E.

NOTES.

Educational Notes. — Goldsmith's College, New Cross, S.E.—An announcement is made in our advertisement pages regarding special summer classes in May and June. Lectures in wireless telegraphy, with practical work, engineering costs and works management, drawing office and workshop practice, &c., are included in the courses.

Crystal Palace School of Engineering.—The new course commences on Wednesday, April 30th. See our advertisement pages in this issue.

Exhibition in Switzerland.—A Domestic and Industrial Electrical Exhibition is to be held at Basle from August 9th to September 14th, on the occasion of the yearly meeting of the Verein Schweizerische Elektrotechniker and the Verband Schweizerische Elektricitätswerke.

The Carléon Train-Lighting Dynamo.—On Tuesday last we were present at a demonstration of a new train-lighting dynamo invented and patented by Messrs. Gavan Inrig, Ltd., who, it will be remembered, recently brought out a new gas turbine. The dynamo was shown running in conjunction with a storage battery at the works of Messrs. Bryant, Symons & Co., Rawstorne Place, E.C.

The principle which is relied upon to maintain constant voltage over a wide range of speeds—in the ratio of 1 : 6—is one with which readers of the Review are not unacquainted, namely, that of withdrawing the armature core from between the poles of the field magnet as the speed rises, so as to diminish the magnetic flux through the armature. The method by which this is accomplished in the "Carléon" machine is ingenious. An obvious difficulty, if the armature is moved as a whole, is the necessity of having a long commutator, or of moving the brushes with the commutator; Messrs. Inrig, however, provide the armature with two concentric cores, a shallow one carrying the winding and commutator, which is mounted on a spider fixed on the shaft at the commutator end, and an internal concentric core sliding on the shaft. The latter is controlled by a mechanical governor of the fly-ball type, acting against a spiral spring coiled round the shaft. Before moving the armature core, the governor compresses a lighter spring and actuates a cut-in and cut-out switch, which closes when the speed is sufficient to generate the necessary voltage, and opens when the speed falls below that point.

Reversal of motion of the train is provided for in the usual way by moving the brushes; these being carried on a frame with very little friction, the pressure of the brushes on the commutator serves to rotate the frame until its motion is arrested by fixed stops. The latter are provided with magnetising solenoids

in series with the exciting current (which is derived from the battery), to hold the frame steadily against the stop.

In normal working, the makers propose to couple the battery in parallel with the lamps and to charge it from the dynamo without the use of any regulating device. Without wishing to discourage the inventor, or to disparage his work, we feel bound to say that, while concentrating his attention on the dynamo, he has omitted the most essential part of a train-lighting equipment designed for use, as this is, with a single battery. The dynamo part of the equipment presents no difficulty; the regulation of the voltage applied to the lamps—not within a few volts, but within a range of 5 per cent. at most, which is about 1 volt—is the crux of the problem.

Smoke Abatement.—At the annual meeting of the Coal Smoke Abatement Society, on April 10th, Sir Wm. Richmond (President), in his presidential address, said the outstanding feature of the year was the International Smoke Abatement Exhibition, when a comprehensive and valuable assortment of apparatus for dealing with factory smoke was on view. It was admitted on all hands that the exhibits of the London electricity companies, who combined to furnish the Electricity Hall with examples of labour-saving and heating appliances, opened the eyes of town dwellers to the fact that in electricity they possessed an invaluable servant for eliminating the smoke fiend. The fact that in a few years the annual output of electricity in the metropolis had reached the total of 242,000,000 units was proof of the value of the services of this, their ally, in the work of cleansing the atmosphere. To the electricity supply companies they desired to tender their expression of grateful appreciation for what they did to help the Exhibition, and were doing to help the cause.

Fatality.—Eastwood.—On 9th inst. an inquest was held into the death of Alfred Naylor, who received a fatal electric shock at New London Colliery on 7th inst. Mr. Fraser, H.M. Inspector of Mines, was present, and Mr. Elliott Smith represented the colliery company and Mr. Whyte, the manager. According to a full report published in the *Nottingham Daily Express*, Mr. J. H. Fox, deputy, said that deceased was going to the switch box to switch off the current working the conveyer, when he stumbled over a rail and fell across the wire. Witness endeavoured to raise deceased by means of a wooden bar, but failed, and he then switched off the current by pulling out the two wires, and deceased fell on the ground. Witness tried artificial respiration for 1½ hours, without success. In reply to Mr. Fraser, he said he found, on severing the wires, that one was loose and came away easily, but the other was fast and pulled the switch box with it. The plant was inspected every other day. Mr. James E. Dawson, chief electrician at the colliery, said he examined the apparatus after the accident, and found a live wire had come out of the coal-cutter switch-box, but everything else was in order. He also found the earth wire disconnected, and thought deceased broke it in falling. The head of deceased took the full pressure, 450 volts. Witness admitted that after the accident he found three of the eight screws fastening the terminals missing, but could not account for their absence. His brother carried out the examination on Friday. He thought it possible for the screws to have come out between Friday and Monday. He admitted that the regulations affecting earth wires were not carried out, but the company were having the necessary appliances made. Had the earth wire not broken, there would have been no danger. Mr. G. E. Dawson, assistant electrician, also gave evidence.

Mr. Whyte, the manager, said it was the first electrical accident since his appointment. The company were at the present time carrying out alterations in conformity with the report of Mr. Fraser, but were having difficulty in getting the material delivered. They were doing their best to conform to the special rules. Witness said the present installation was strong, but admitted that the earth wire would not have broken (unless defective) with a man's weight leaning on it. Dr. Northwood said the deceased was burned on the face and chest from contact with a live wire, death being due to shock. The jury returned a verdict of "Accidentally killed," and added that the colliery company should take steps to cover or provide better protection for the wires.

Alleged Stealing.—Thos. Shuttleworth, metal broker, of 3, Carroll Street, was committed for trial by Preston magistrates, on April 11th, for stealing 78½ lb. of phosphor bronze, the property of Messrs. Dick, Kerr & Co., electrical engineers, valued at £2 16s. 7d. A detective-sergeant said whilst searching for certain property at prisoner's warehouse he found several ingots of phosphor bronze and "anti-friction" bronze under scrap brass in the coal hole. In the kitchen was about a ton of white metal.

The Bench considered there was a *primâ facie* case to answer, but they allowed bail.

International Building Trades Exhibition.—This Exhibition, which is the fifth of the biennial series held at Olympia, was opened on Saturday, April 12th, and will close on April 26th.

Practically every inch of floor space is given over to firms immediately connected with the building trade, exhibits of electrical interest being comparatively few and far between. It is rather surprising to note the entire absence of the small internal-combustion engine-driven lighting set, particularly because there are several firms exhibiting petrol air-gas machines suitable for country house lighting.

Messrs. R. Waygood & Co., Ltd., have an electrical passenger-lift operating between the ground floor and the gallery, and models of Waygood's patent "Electroll" and full automatic passenger-lifts. Messrs. Marryatt & Place show a standard pattern passenger lift with push-button control and two speeds. This lift operates in a lofty steel tower and gives a view over the whole exhibition. Messrs. Medway's Safety Lift and Elevator Co. exhibit a passenger lift suitable for control either by a single switch in the cage or by push-buttons. Messrs. Scholey & Co. are exhibiting a large model of the "Graham" lift with push-button control, and a 6-cwt. passenger lift gear.

Messrs. Ozonair, Ltd., are showing their portable apparatus in a variety of types and sizes, and a show-case contains a model ventilation and air purification plant as installed on the C.L.R.

Messrs. F. & C. Osler, Ltd., show a very fine selection of their well-known metal and cut crystal electric light fittings. Other firms exhibiting electric fittings are Messrs. Tuke & Bell, Ltd., Dryad Works, and the Linolite Co., Ltd.; the last-mentioned firm are showing "Tubolite" fittings and "Woodhouse" steel casing. Messrs. Holophane, Ltd., exhibit a selection of their pressed-glass prismatic reflectors. The Carron Co. show an electric kitchen range, and Messrs. Blackstone & Co., Ltd., various types of oil engines. Electrically-driven vacuum cleaners are shown by the British Vacuum Cleaner Co., Ltd. Water softeners are exhibited by Mr. W. Boby; and the Kennedy tube-bender, by Mr. W. Kennedy.

An interesting line of electrically-driven rotary floor-surfacing machines is shown by Messrs. H. R. Wilson. These machines are also adaptable for bench use.

Among other firms might be mentioned the Brilliant Sign Co. (illuminated signs), Messrs. W. H. Willcox & Co., Ltd. (semi-rotary pumps, lubricating specialities, &c.), Messrs. J. H. Heathman & Co., and H. C. Slingsby & Palmer's Travelling Cradle Co. (tower ladders, &c.), the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (rubber tiling), Messrs. J. B. Stone & Co., Ltd. ("Alligator" and other belt fasteners), &c. Several manufacturers of woodworking, paint, and other milling machinery are fitting their machines with electric motors as standard practice.

Institution and Lecture Notes. — Association of Mining Electrical Engineers.—A special meeting of the Notts. and Derbyshire Branch of the Association was held at Chesterfield on Saturday evening. It was decided to hold one meeting a quarter at Chesterfield, one during the session at Mansfield, and the other monthly meetings at Nottingham. A discussion took place on a paper on "Cable Jointing and Junction Boxes," by Mr. Chris. Jones.

Association of Engineers-in-Charge. — The eighteenth annual dinner of this well-known and useful Association was held on Saturday evening last at the Holborn Restaurant. About 300 persons were present, the President of the Association, Prof. H. S. Hele-Shaw, F.R.S., occupying the chair, and Mr. H. E. Neale the vice-chair. The guests included Mr. T. A. Coghlan, S.I.E., Agent-General for New South Wales, Sir Hay F. Donaldson, K.C.B., His Honour Judge Rentoul, Sir A. B. W. Kennedy, F.R.S., Mr. Henry Adams, Mr. Frank Bailey, Mr. H. P. Boulnois, Mr. Philip Dawson, Mr. Frank Broadbent, Capt. Sankey, and the Ven. W. M. Sinclair.

After the loyal toasts had been duly honoured, the toast of "The Engineering Profession" was proposed by Mr. T. A. Coghlan, who referred in the course of his remarks to the engineering needs of Australia, and to the fact that, as the representative of one of the Colonies, he felt that he came not as a stranger, but a friend. In responding to the toast, Sir Hay F. Donaldson emphasised the fact that the problem of Australia was the supply of water. How to irrigate the country was an engineering problem, and there were few countries where the engineer's opportunity was so marked, or the reward so valuable. The adaptability of the engineer made him a very valuable arrival, and he considered that amongst the members of that Association there were few who could not in almost any situation make good use of their engineering skill. They were all well equipped to take advantage of any opportunity which might present itself to them.

Mr. Alfred E. Penn, the honorary secretary of the Association, proposed the toast of "Kindred Institutions and Our Guests." He referred to the help which the Association received from other Institutions, and thanked all the distinguished men who had in many ways helped them, and had often honoured their annual dinner with their presence. The large and enthusiastic assembly was a proof of the vitality of the Association, which was able to act in many ways as a real help to its members. The toast was responded to by his Honour Judge Rentoul, who reminded the audience that he had been present at so many of these annual dinners, that he was beginning to look upon himself as quite an institution. He always enjoyed their company, and hinted that he hoped the time would never come when they would not enjoy being in his company. After referring to the importance of the work carried on by the members of the Association, the Judge said that without in any way touching on political matters, he would ask them a question which had somewhat puzzled him. It related to the time when the value of a Mexican dollar was 4s. in Mexico, and 3s. 10d. in the United States, and the American dollar was worth 4s. in the United States, and 3s. 10d. in Mexico. A Mexican with a dollar in his pocket went to a public-house on the Mexican side of the frontier and bought two-pennyworth of whisky. He received as change an American dollar worth 3s. 10d., and forthwith he crossed the frontier and bought another two pennyworth of whisky at the first public-house. Receiving as his 3s. 10d. change a Mexican dollar, he recrossed the frontier and repeated the process. At last he was found dead drunk with the Mexican dollar in his pocket. There was no doubt the man had bought, paid for and drunk the whisky. He had the same amount of money at the end of his venture as at the start! Query—who had paid for the whisky?

Mr. Sydney Brooks proposed the toast of "The Association," which was responded to by the President, Prof. H. S. Hele-Shaw, who pointed out the happy combination made by the Associa-

tion of the social and educative branches of its work. He thanked them for the honour they had done him by electing him as their president, and was convinced that the future of the Association would prove as successful as its past. He urged them to do all they could to increase their membership, and so strengthen the Association. A capital musical programme concluded a very successful evening.

Mr. G. C. Milnes, electrical engineer to the Lancaster Corporation, in conjunction with Mr. W. McBretney, on April 10th gave a lecture and demonstration in "Wireless Telegraphy and Telephony" before a large audience of the Lancaster Astronomical and Scientific Association.

Association of Teachers in Technical Institutions.—The annual conference of the Association will be held this year in Bradford at Whitsuntide. The Lord Mayor of Bradford will officially welcome the conference to Bradford on Whit Monday, and the President, Mr. P. Coleman, of the Northern Polytechnic Institute, will deliver an address. The meeting on Tuesday evening will be addressed by the Right Hon. J. A. Pease, President of the Board of Education, and in view of the introduction of the new Education Bill soon after Whitsuntide, this address will be looked forward to with exceptional interest. Papers will be read on "Corporate Life in a Technical Institution," by Mr. W. Hibbert, of the Polytechnic, Regent Street; "Vocational Education," by Mr. A. C. Coffin, Director of Education, Bradford; and "Co-ordination within a County Area," by Mr. F. N. Cook, Secretary for Higher Education in the West Riding of Yorkshire.

Institution of Electrical Engineers.—On Thursday last week, Dr. E. Rosenberg read his paper on "Self-Synchronising Machines," before the Institution in London, and a discussion followed.

(Yorkshire Section).—A lecture was given by Mr. F. Simpson on "Prices Charged for Electrical Power," at Leeds, on Wednesday last. A discussion followed, and was adjourned.

Illuminating Engineering Society.—On Tuesday a paper by Mr. A. P. Trotter on "Standard Clauses for Inclusion in a Specification of Street Lighting" was discussed. A report will appear in our next issue. The discussion was adjourned to April 29th.

Electrical Trades Benevolent Institution.—On Thursday evening the annual festival dinner was held; the President, Mr. George Sutton, occupied the chair, and made an excellent speech in recommendation of the objects of the Institution, which was supported by Mr. A. B. Anderson, vice-president. The President announced that during the evening the sum of £854 6s. had been subscribed—almost double the amount received at the festival dinner last year. Proposing the health of the chairman, Mr. E. Byng offered to give £100 to the funds, if nine other sums of £100 were obtained within three months; as Mr. H. Hirst and Mr. G. Sutton would contribute £100 each, only seven such donations were required to fulfil the conditions of the offer, which was cordially commended to the audience by the President. A full report will appear in our next issue.

Inquiries.—The makers of the "Dickinson" trolley harp are asked for.

Appointments Vacant.—Lecturer in mathematics (£400 and quarters or £100 allowance), and lecturer on strength of materials (£350 and quarters or £100 allowance), for the University of Hong Kong; junior assistant superintendent of telegraphs for the Telegraph Department of Ceylon (£300); manager and secretary for the Minehead Electric Supply Co., Ltd. (£180 and percentage of profits); assistant clerk and collector (30s.), and junior switchboard attendant (20s.), for the Borough Electricity Department, Torquay. See our advertisement pages in this issue.

Electrical Trades Union.—To-morrow night at the Fulham Town Hall there will be a smoking concert, at which the chairman will be Mr. James O'Grady, M.P., supported by Mr. J. Kinniburgh, organiser of the E.T.U.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On Saturday last at All Saints' Church, Gosforth, Mr. H. S. Ellis, borough electrical engineer, of South Shields, fourth son of Sir J. Baxter Ellis, of Newcastle-on-Tyne, was married to Ida Beatrice, elder daughter of Mr. and Mrs. Henry Mosely, of Gosforth. After the ceremony a reception was held at Tilley's Rooms, in Market Street. The gifts, which were very numerous, included a grandfather's clock presented by the staff and workpeople of the Corporation electricity works at South Shields.

Mr. G. S. McLaren, of the British Westinghouse Co.'s meter testing department, has been appointed meter engineer at Taunton electricity works.

The staff and employés of the Birkenhead Corporation electricity works have presented a gold watch to Mr. W. H. Fennet, shift engineer, on his departure for Canada.

General.—Mr. G. Wilson, who has had charge of the electrical department of the North Staffs. Railway in the Uttoxeter district, has secured an important appointment under the Egyptian Government Railway.

Mr. G. Gilkes, of Messrs. Gilkes & Co., turbine makers, of Kendal, has been elected chairman of the Westmorland County Education Committee.

A complimentary dinner was given by various engineering friends to Mr. P. V. Brownhill at the Progredeor Restaurant in Sao Paulo, on the 25th ult., on his leaving the South American staff of Messrs. J. Stone & Co., Ltd., of Deptford, London, to take over the important position of electrical engineer to the Paulista Railway Co. The chair was taken by Mr. J. A. Hamp, M.I.E.E., of the Sao Paulo Railway Co., and amongst those present was Mr. M. B. Chater, late of the Buenos Ayres and Pacific Railway Co., who is succeeding Mr. Brownhill as Messrs. J. Stone & Co.'s representative in Brazil. After a very pleasant dinner and loyal toasts usually indulged in by Britishers abroad, the company adjourned to the Sao José Theatre, and witnessed the performance of the well-known musical opera "A Viuva Alegre" ("Merry Widow").

The marriage took place at Holy Trinity Church, Chesterfield, on April 9th, of Mr. A. B. Impey, assistant manager of telephones for the Chesterfield district, and Miss Margaret Mary Saunders, eldest daughter of Mr. C. J. Saunders, of Brockwell House, Chesterfield.

Mr. G. C. Milnes, borough electrical engineer, Lancaster, has been elected treasurer to the Lancaster Municipal Officers Association.

Mr. L. N. Mills, recently with the British Thomson-Houston Co., Ltd., Rugby, has now joined the staff of the Electric and Ordnance Accessories Co., Ltd., and is engaged in the sales department at their Birmingham works.

Tramway Officials.—At a meeting of the Aberdare U.D.C., held on Monday evening, Mr. H. King, traffic superintendent of the Merthyr Electric Traction Co., Ltd., was selected out of 120 applicants for the post of traffic superintendent to the Aberdare Council.

Obituary.—Mr. E. B. Bright.—Telegraph engineering has lost another of its few remaining pioneers by the death, at the age of 82, of Mr. Edward Brailsford Bright, at Tottenham, on Monday morning. Edward Bright, elder brother to the late Sir Charles Tilston Bright, of Atlantic Cable fame, was born in 1831, and was the second son of Brailsford Bright. Cooke and Wheatstone's electric telegraph had lately been instituted under the ægis of the Electric Telegraph Co., which the two brothers joined in 1847, when respectively 16 and 15 years old. This came about through answering a *Times* advertisement for gentlemen's sons with education. Within a year of entering upon their new field, both boys became inventors, working together in more or less double harness. In those days, patent fees of £150 had to be paid, so the brothers contented themselves, for the time being, with starting a joint invention book, into which they, from time to time, entered up drawings, descriptions and dates. These were afterwards, with several additions, embodied in the famous patent of October 21st, 1852. It suffices to say here, that many of the novelties included therein are now in common use after a lapse of half a century. Perhaps the most important of their early inventions was the system, devised in February, 1849, of testing insulated conductors to localise faults from a distant point, by means of a series of standard resistance coils of different values, brought into circuit successively by turning a connecting handle, which enables repairing vessels to at once go to the scene of damage, instead of having to pick up and cut the cable here, there and everywhere at haphazard. The year 1851 saw some important changes in the lives of both the brothers. Charles left the "Electric" Co., and shortly after became engineer to the lately formed British Telegraph Co., whilst Edward joined the Magnetic Telegraph Co. Thus, the two brothers became engaged in advancing the early stages of two competing concerns. On the success of the Magnetic Co. being demonstrated, capital was quickly forthcoming for the organisation of a powerful chartered company entitled the English and Irish Magnetic Telegraph Co. In 1852, when only 21 years old, Edward Bright became manager of the "Magneto" Co. It was in this year that the brothers took out their famous patent, to which allusion has already been made. It contained 24 distinct inventions connected with telegraphs, and it may be well here to enumerate some of the more important. First of all, there was the porcelain insulator for fixing aerial telegraph wires mounted on posts, and, in one form or another, it continues in use to the present day. There was also its adjunct, the shackle or terminal insulator. This is also made of porcelain, and is universally employed for terminations, and whenever the wire has to be taken at an angle—over houses, for instance, round a corner, or in any case where great strains are involved. Then followed the now universal system of aerial telegraph posts, with varying length of arms, to avoid the chance of one wire dropping on another. After this came the brass tape device for the protection of insulated conductors of subterranean, or submarine, cables. There was then a translator, or repeater, for retransmitting electric currents of either kind in both directions on a single wire, also a standard galvanometer (foreshadowing differential testing) and a new type-printing instrument, as well as what was then a novel method of laying underground wires in troughs. At the outset of the "Magnetic" Co.'s operations the brothers found it necessary to devise fresh apparatus to compensate for the inductive discharge resulting from the long underground circuits, by discharging to earth and thus neutralising the recoil currents. Some of the results of these researches were detailed and illustrated experimentally by Edward Bright, at a meeting of the British Association at Liverpool, in 1854, in an address on "The Retardation of Electricity through Long Subterranean Wires." During 1855, young Bright thought out another important invention with his brother. This consisted of a system of duplex telegraphy which was worked successfully between London

and Birmingham. Charles Bright remained engineer-in-chief to the "Magnetic" Co. until about 1860, from which time (owing to press of other work) he held a consulting position only. Thereupon Edward Bright assumed the engineership in addition to the general management. Subsequently Sir Charles Bright went into partnership with the late Mr. Latimer Clark, but the brothers were again associated with each other from the year 1869 up to the time of the former's death. On the transfer of the Inland Telegraphs to the State, Edward Bright in 1869 became an independent engineer. Like his brother, he was an important factor in many Government Bills and arbitrations, and one of his more important late inventions was the electric fire alarm, modifications of which may be seen on so large a scale in our streets, warehouses, &c. As in the case of Sir Charles, though a prolific inventor and able engineer, Edward Bright died a poor man, which, indeed, he had been since his retirement some years ago. He was a member of the Institution of Civil Engineers, and a Member of Council of the Institution of Electrical Engineers, and originally with the late Dr. Dionysius Lardner, he brought out a work entitled "The Electric Telegraph," which, in its revised form, had a considerable sale. It is with the quite early, even youthful, work of this distinguished engineer that we have chiefly dealt, because—as in the case of his eminent brother—this undoubtedly formed the most remarkable feature of a distinguished career. His nephew, Mr. Charles Bright, F.R.S.E., so well known to our readers, is now the only remaining representative of the family engaged in the development of telegraphy.

Mr. E. M. Underdown.—We regret to record the death which occurred suddenly on the night of April 11th, while entering a lift at the Strand tube railway station, of Mr. Emanuel Maguire Underdown, K.C., chairman of the Direct United States Cables Co., Ltd., for many years. The deceased gentleman was called to the bar in 1861, had been on numerous missions to foreign countries, was a prominent Freemason, and was very much esteemed in submarine cable circles. His son, Mr. Harry C. B. Underdown, is a director of the Direct United States Cables Co. The funeral took place at Knightsbridge on Tuesday.

Ald. E. Haslam.—The death occurred, on April 9th, of Ald. Edwin Haslam, who had for many years carried on an electrical engineering business at 233, St. Helen's Street, Derby. The deceased, who was 70 years of age, was a brother of Sir Alfred Haslam, and had served on the Derby Town Council for 24 years.

Mr. W. Loxley.—The death is announced, at the age of 82 years, of Mr. Wm. Loxley, for many years manager for Messrs. E. Green & Son, Ltd., the well-known engineers of Wakefield. The deceased, who had spent over 50 years with the firm, superintended the erection of Messrs. Green's American works at Matteawan, New York.

CITY NOTES.

Nairobi Electric Power and Lighting Co., Ltd.

The directors report continued satisfactory progress during 1912. The figures are as follows:—

	1910.	1911.	1912.
Units generated	416,621	581,418	604,894
Motors connected, B.H.P.	147	173	248
Lights connected, 8-C.P. equivalents	5,932	8,193	10,658
Street lighting	2,000	2,000	2,000
Net profit	£403	£2,027	£2,642

There have been some exceptionally heavy expenses during the year 1912, in connection with leave pay and travelling expenses of the company's chief engineer and others, whose time for leave happened to fall within the year, and it is hoped that for 1913 the accounts will show a considerably increased income with smaller expenditure. It was reported last year that further power stations were to be installed on the Ruera River, but in consequence of negotiations with the Government, these new installations are delayed. Mr. Charles Udall, the chief engineer, has visited England for some months on holiday, and has resumed his post at Nairobi. The company has now reached a dividend-paying stage, and out of the balance shown in revenue account the directors have declared an interim dividend of 6 per cent. on the preference shares for the years 1906 and 1907, which was duly paid in January last. Although the remaining balance is sufficient to pay the same for another year, they recommend that, for the present, it be carried forward.

Lancashire Power Construction Co., Ltd. — The report states (says the *Financier*) that the accounts for the year 1912, after deducting the credit balance of £1,101 brought forward, show a debit balance of profit and loss account of £2,613. The annual meeting was held in London yesterday.

Monte Video Telephone Co., Ltd.—The directors have declared an interim dividend for the half-year ended January 31st at the rate of 5 per cent. per annum on the preference shares and 6 per cent. per annum on the ordinary shares.

Anglo-American Telegraph Co., Ltd.—The directors have resolved to declare an interim dividend for the quarter ending March 31st, 1913, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable May 1st.

Babcock & Wilcox, Ltd.

The directors' report for the year ended December 31st, 1912, shows a net profit of £426,147, plus £69,467 brought forward, making £495,614; deducting the interim dividends of 3 per cent. on the preference shares, and of 7 per cent. on the ordinary shares, amounting to £119,200, there is a balance of £376,414, from which the directors recommend the following dividends for the half-year ended December, viz., 3 per cent. on the preference (less income-tax), £3,000, 9 per cent. on the ordinary shares (free of income-tax), £149,400; placing to the reserve fund £150,000, and to the staff pension fund £10,000, leaving to be carried forward £64,014. The volume of business done during last year, and that carried forward into 1913, shows an increase over any previous period. The scope of the business, both in land and marine boilers and in other manufactures, is continually being extended. In common with other manufacturing concerns, work during the year was much hampered by the coal strike, and the cost of production is enhanced by the higher rates of wages and materials now ruling, the increased cost of coal, and the expense resulting from the Insurance Act. To counteract this, further extensions, both to the company's selling and manufacturing organisations, have been, and are still, being carried out. Having regard to this, it is considered desirable to further increase the company's cash resources, and the directors recommend the issue of £200,000 in 5 per cent. cumulative second preference shares at par. It is proposed to offer these shares to the holders of the present preference shares. It is recommended to make the same provision for the staff pension fund as was made last year.

Midland Electric Corporation for Power Distribution, Ltd.—The directors' report for the year ended December 31st (as abstracted in the *Birmingham Daily Post*) states that the increase in both revenue and profit has been much greater than in any previous year, and this result has been obtained partly because of the additional consumers secured, and partly through the exceptionally good trade in the area covered by the company's orders. The balance to the credit of the net revenue account is £12,843, which the board recommend be applied as follows:—Provision for debenture guarantee premium, £1,250; written off expenses of issue of debentures and ordinary shares, £2,444; transferred to depreciation account, £2,899; carried forward as a provision for the payment of the premium due on the redemption of the debenture bonds now outstanding, £6,250. These debentures, amounting to £250,000, will become due for redemption on June 30th next, and arangements are being made to provide for this, and also for the additional sum necessary for the capital requirements of the company. During the year further capital amounting to £27,653 has been expended. The 3,000-kw. turbo referred to in the last report was not delivered in 1912, the delay being due partly to the coal strike in March, 1912. It has now been delivered and erected.

Indo-European Telegraph Co., Ltd.—The directors, subject to final audit, recommend the payment of a dividend for the six months ending December 31st, 1912, of 17s. 6d. per share (making with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free from income-tax. They also recommend a special distribution of 15s. per share, free of income-tax, out of interest accrued during the year upon certain investments and advance accounts. The dividend, bonus and special distribution as above will be payable on and after May 1st next. The transfer books will be closed from April 16th to 29th inclusive.

Guildford Electricity Supply Co., Ltd.—Mr. H. P. Smallpiece presided at the recent annual meeting, and in moving the adoption of the report, he said that the gross revenue had increased by £1,390 to £10,069. The costs had gone up by £738. This was an eminently satisfactory state of affairs. The directors had considered it advisable to write off on the depreciation fund account £1,250, as against £1,000 written off annually during the past few years, putting £500 to reserve as against £400 in the preceding year. They had acquired a very valuable site of freehold land adjoining the original works, which would afford ample scope for the development of the business for many years. The report was adopted, and a 5 per cent. dividend approved.

Telephone Company of Egypt, Ltd.—The directors have declared a dividend of 6 per cent. (6s. per share), free of income-tax, on the preferred and deferred shares for the half-year ended December 31st, making 10 per cent. for the year; £2,000 is placedito staff pension fund, and £112,698 is carried forward.

British Columbia Electric Railway Co., Ltd.—The directors have declared an interim dividend at the rate of 8 per cent. per annum on the deferred ordinary stock for the half-year to December 31st.

La Plata Electric Tramways Co., Ltd. — The directors have declared a dividend of 6 per cent. per annum on the preference shares.

Indian Electric Supply and Traction Co., Ltd.—The directors report that during the year to December 31st the paid-up share capital has been reduced from £130,035 to £78,021. The surplus on the year's working in Cawnpore, including interest accrued, was £8,458, and, after providing for debenture interest, a dividend of 4 per cent. is recommended for the year, carrying forward £1,834.

Anglo-Argentine Tramways Co., Ltd.

The annual report for 1912, which is to be submitted to the annual meeting at Winchester House, E.C., on Monday next, states that the gross receipts amounted to £2,778,303, less working expenses (which include various items amounting in the aggregate to £135,000 carried to depreciation renewals funds, in addition to £301,181 expended on ordinary maintenance) £1,824,022, leaving £954,281 plus £10,947 brought forward, making £965,228, less interest and charges as per net revenue account £755,922, leaving £209,306, less interim dividend of 4 per cent. on ordinary shares for half-year ending June 30th, 1912, £100,000 = £109,306. Out of this balance, the directors recommend that a final dividend of 4¼ per cent. be paid on the ordinary shares for the half-year ending December, 1912, making 8½ per cent. for the year, which, after deduction of income-tax £6,198 will absorb £100,052, leaving £9,254 to be carried forward. The construction and equipment of the first subway line from Plaza Mayo to Plaza Once, a distance of over two miles, is progressing satisfactorily, and it is expected that this section will be open for traffic in October next. In order to meet the disbursements in connection with the construction of the subways, the properties required in connection therewith, new extensions, additional rolling stock, and under the powers conferred by the resolution of the company of June 1st, 1910, a further issue of £1,500,000 5 per cent. debenture stock was made in October last at a price of 98½ per cent. The directors report the death of Mr. Hector Monnom, a director. Mr. Georges de Laveleye, president of the Bank of Brussels, has been elected to fill the vacancy. The board again place on record their appreciation of the services rendered during the year by the local committee, the general manager, and the staff of the tramway generally, both at home and abroad.

As usual, there is published, together with the directors' report, a report by the general manager, in which he states that while the Government during the year 1912 has continued its progressive policy, in the commercial world affairs have not been satisfactory on the whole. The depression which commenced in 1911 was further accentuated by the disappointing results of the wheat harvest (1911-12).

Building of big houses in the central districts has continued on a large scale, and great changes are noticeable in almost all streets, the old one-storeyed buildings being now practically a thing of the past in the centre. Building in the suburbs has, however, considerably diminished, and rents, which had risen enormously during the past years, are now stationary, and have even, in some instances, been reduced.

Immigration is greatly improved. The population of the city shows an increase of 5·1 per cent.

Although not up to the standard of previous years, the increase in the number of passengers carried by the company as compared with 1911 is still quite satisfactory, in spite of the poor commercial results of the year. In passengers carried the increase was 5·72 per cent., and in car km.-run 3·79 per cent. The increased rolling stock has permitted of more thorough and frequent overhaul of cars. The number of breakdowns and interruptions caused through deficient working of cars has remarkably decreased. The daily average number of cars that entered for repairs has gradually decreased from 2·8 per cent. in December, 1911, to 0·6 per cent. At December, 1911, there were 1,539 motor-cars, two parlour cars and 666 trailers, and at end of 1912, 1,758 motor-cars, two parlour cars and 807 trailers.

The more important works carried out in 1912 were :—Revised and partially reconstructed, 268 motors ; repainted, 630 motors, 404 trailers ; partially repainted and revarnished, 1,251 motors ; seven trailers : new cars erected in 1912, 219 motors, 200 trailers. Much work has been done on maintaining the overhead installation in good state of repair, and the number of cases of breakages has consequently not been important. These accidents will be still further considerably reduced when the company has fully complied with the new municipal ordinance that disposes that telephone protection wire shall be suppressed altogether in the centre of the city, and in the outskirts only one protection wire is to be placed. Over 80,000 metres of wire of 80 mm.² have been employed for the renewal of trolley wire.

The underground feeder system has worked satisfactorily. Very considerable permanent-way work has been done. Paving works all over the city have been continued on a fairly large scale, and this has necessarily affected permanent way installations to a good extent. The weather in 1912 was, from a tramway point of view, on the whole even worse than in 1911. The passengers per car km. increased from 4·04 to 4·11.

Expenditure increased by £88,644 (5·62 per cent.), wages amount accounting for £55,360, stores £17,737, and taxes £20,792 ; current diminished by £6,702. Wages have a continuous tendency to increase and hours of labour to diminish. The pay of guards and motormen of the first and second grades was increased from November, 1911, from $4.20 and $4.00 per day to $4.50 and $4.25 per day. The increased expenditure for 1912, due to the higher rate of pay, amounts to £12,440. The taxes paid during 1912, exclusive of concession taxes and advertising taxes, amount to $2,657,493 paper, or £230,000, equal to 8·32 per cent. of the gross receipts. Advertising taxes amounted to £10,000. Notwithstanding the high coal freights and the increased cost of current per KW.-hour, the increased car km. run (2,811,606), and the consequences of the miners' strike in England, electric current has cost £6,702 less than in 1911.

Fortunately a considerable economy has to be recorded in the average consumption per car km. which in 1911 reached 767 watt-hours, whereas in 1912 the average was reduced to 688 watt-hours, a decrease of 10·30 per cent.

The percentage of expenditure on receipts has varied slightly, being for 1912 60·52 per cent. in comparison with 60·41 in 1911, notwithstanding the unavoidable increases in payments for 12 per cent. Muncipality tax and for extra cost of current. Amongst the staff, there has been entire freedom from agitation, and the men seem, in general, to be perfectly contented. This is due to the company's method of treating them well. Providing for the families of the employés in the shape of the Mutual Aid Society has undoubtedly been one of the most important factors, together with the security they have of some provision in the case of death. The manager enters in detail into the work of this mutual aid society.

The construction of the subway between Plaza Mayo and Once has proceeded rapidly during the year, and the actual excavation for the tunnel was approaching completion by the end of December. Much work was done in the completed tunnel in the shape of electrical installations, painting, staircases, preparing platforms at stations, &c. It is anticipated that the first section can be inaugurated in October, 1913. Preliminary works and surveys were also carried out for the extension of the first section to Caballito, as also for the line from Retiro to Constitucion. There has been a satisfactory year as regards dealings with the Municipality. In July the Municipal Council granted the company a concession for various new extensions, amounting to some 45 km. of new track, comprising a new line between Once and Chacarita, extension of the lines in Entre Rios and Calle Velez Sarsfield as far as the Riachuelo, a new line *viâ* Calle Neuquen to Villa Santa Rita, and several other short extensions and connecting lines. These extensions come into the company's concession without any new onerous conditions.

Comparative Table.

Year.	Receipts.	Expenditure.	Passengers carried.	Miles run.	Receipts per mile run.	Expenses per mile run.	Cars in stock.
1910	£2,419,186	£1,564,093	276,426,524	42,881,395	13·54d.	8·14d.*	2,156
1911	2,631,886	1,723,928	299,154,885	46,019,928	13·73d.	8·36d.*	2,207
1912	2,778,302	1,824,021	316,260,077	47,765,667	13·96d.	8·49d.*	2,567

* Does not include credits or debits to depreciation renewal funds.

Stock Exchange Notices. — Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Canadian General Electric Co., Ltd.—Further issue of 1,900,000 dols. common stock, in shares of 100 dols. each.

And to allow the following securities to be quoted in the Official List :—

Calgary Power Co., Ltd.—Further issue of £48,900 5 per cent. 30-year first mortgage bonds of £100 each (Nos. A 4,112 to 4,600).

Companhia Ferro Carril do Jardim Botanico (Jardim Botanico Tramway Co.).—Further issue of £200,000 5 per cent. 40-year first mortgage bonds of £100 each.

Empire District Electric Railway.—2,921,000 dols. first mortgage 5 per cent. sinking fund gold bonds of 1,000 dols. each.

London Electric Railway Co.—932,794 ordinary shares of £10 each, fully paid (Nos. 1 to 932,794) (special application).

The Committee have appointed a special settling day, as under :—

Wednesday, April 30th.—Shawinigan Water and Power Co.—Further issue of $1,000,000 capital stock, in shares of $100 each.

And ordered the undermentioned to be quoted in the Official List :—

Adelaide Electric Supply Co., Ltd.—£75,000 additional 5 per cent. debenture stock.

Bell's United Asbestos Co., Ltd.—60,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 140,001 to 200,000).

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £53,000 5 per cent. 50-year mortgage bonds of £100 each (Nos. B29,631 to 30,160).

Shawinigan Water and Power Co.—Further issue of $1,000,000 capital stock, in shares of $100 each.

Vancouver Power Co., Ltd.—Further issue of £50,000 4½ per cent. perpetual guaranteed debenture stock.

Holsworthy Electricity and Gas Co., Ltd.—Presiding at the third annual meeting Mr. W. Kivell said he regretted that the growth of the electrical undertaking was slow. The units sold during the year were £9,868. In consequence of the great rise in the price of fuel the directors had deemed it prudent to increase the price of electric current for power from 2d. to 3d. per unit, the increase to take effect from April 1st. The net credit balance, after providing for debenture interest, was £366, as against £467 for 1911, and it was resolved to allocate the balance as follows : Dividend of 4 per cent. to be paid ; £25 carried to depreciation account, electric undertaking ; £44 to be written off preliminary expenses account, and £38 to be carried forward. Thanks were accorded the chairman, the secretary (Mr. J. Rowland), and the manager (Mr. Illingsworth).

Bude Electric Supply Co., Ltd.—The *Financial News* states that the total receipts on revenue account for the year 1912 amount to £2,010, and the working expenses to £684, leaving a gross profit of £1,325. After deducting interest on debentures and temporary loans there remains a net profit of £1,200, which, with the balance brought forward of £111, makes a total of £1,311 available. The directors recommend a 7 per cent dividend, and commission to secretary, absorbing £727 ; £440 to depreciation account, which is now increased to £1,300 ; and £144 is to be carried forward.

Bank Rate.—The bank rate was yesterday reduced from 5 per cent. to 4½ per cent.

Automatic Telephone Co., Ltd.

Mr. James Taylor, J.P., presided over the first annual meeting of this company, held in Liverpool last week. In moving the adoption of the report (see Electrical Review, page 572), he said that the profit, £13,498, was satisfactory for the first year's working of the company, formed for the purpose of introducing a new commodity. Dividend on the 6 per cent. preference shares had been paid, absorbing £11,815, and £1,813 had been written off preliminary expenses, leaving a balance to be carried forward of £370. The company started business on January 1st, 1912, and in the early part of the year automatic exchanges at Epsom and the General Post Office, London, were completed and handed over to the Post Office, and to the public making use of them. As a result of their satisfactory working, the Post Office had placed with the company an order for an automatic exchange at Leeds, to start with an equipment of 6,800 lines. The company were now negotiating, with good prospects of success, for further orders for different towns in this country. An order had been received for an automatic exchange in Cordoba, Argentina, and two representatives of the company were touring the Far East giving demonstrations in the various countries where the company held rights, and there was every prospect of satisfactory business resulting. There was no doubt that the telephone system in this country required improved plant and extension on a large scale, and it was to be hoped that no false notions of financial economy or demands for expenditure in other directions would be allowed to interfere with the provision of the telephone facilities which the public expected, and to which they were entitled, more especially as experts in the telephone business were unanimously of opinion that a handsome return could be earned on a large amount of further capital judiciously expended. The company had received continual and effective assistance from the Automatic Electric Co., of Chicago, but as progress was made at the Liverpool works in the manufacture of automatic equipment, the proportion purchased from Chicago was gradually decreasing.

Mr. D. Sinclair seconded, and the report and balance-sheet were unanimously adopted.

None of the directors were yet due to retire.

Imperial Tramways Co., Ltd.

In the Chancery Division on Tuesday, April 8th, Mr. Justice Swinfen Eady sanctioned a scheme of arrangement on the petition of the company.

Mr. Clausen represented the company, and stated that the scheme was exceedingly simple. The shares of the company consisted of cumulative preference shares and ordinary shares. The preference dividend was three years in arrear. Certain funds were set aside some years ago, and ear-marked for division among the ordinary shareholders. The ordinary shareholders claimed that that money belonged to them, and was not applicable to pay the preference dividends. Circumstances had arisen which made it very desirable to clear up all questions as to arrears of dividends. The scheme proposed, therefore, was that the preference shareholders should waive their rights to the three years' dividends for 1909-10-11, the preference dividend to be paid from January, 1912, onward. The ordinary shareholders would waive their claim to the special fund, and allow it to go to a general fund of profits, so as to pay the preference dividend at once. The rights of the preference shareholders were contained in the memorandum, and the effect of the scheme was that the preference shareholders waived the rights conferred upon them by the memorandum. The meeting in support of the scheme was very nearly unanimous; no one now opposed the petition.

His Lordship sanctioned the scheme.

Johnson & Phillips, Ltd.—The directors' report for 1912 states that the profit on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £6,000 for maintenance of buildings, plant, &c., amounts to £28,325, plus £1,033 brought forward, making £29,358. From this there are to be deducted:—Remuneration of directors, auditors' and trustees' fees, £1,378; interest on debenture stock, £6,772; reserve *re* debenture sinking fund, £6,143; interest on second debentures, £2,250; depreciation on machinery and plant, &c., £5,640; interest on loan, £546; amount written off patents, licences, &c., £1,306; cost of issuing second debentures, £2,007, carrying forward £3,315. The directors have appointed Mr. G. E. Davis, Mr. H. J. Sheppard and Mr. E. M. Dence as additional members of the board. The meeting is called for April 24th.

STOCKS AND SHARES.

Tuesday Evening.

Markets in most cases have assumed a stronger tone during the past few days. For this the reason is that the Balkans outlook is regarded as more settled, while the fact of money becoming cheaper is a powerful stimulant to an improvement in prices. There is a little public buying going on in certain of the markets; and even in those which have not this lever to help them, the anticipation is that the demand will spread to them later, and so prices there, also, are disposed to harden.

The Home Railway market shows a good deal of strength. The eye which hitherto has been fixed, wide open, on possible labour troubles, is beginning to relax its strain, and the attractions of Home Railway stocks from the investment point of view are coming into stronger focus. To what extent this is a far-sighted view it is not for us, perhaps, to venture an opinion; but in matters of investment, as in other things, it is often as well to fix upon a line of policy and to stick to it. The capitalist, therefore, who has made up his mind to keep out of the Home Railway market for fear of labour disputes, may be well advised to resist the temptation to buy just because everybody else is doing the same thing.

This does not necessarily apply to electrical stocks, for they are governed by a set of conditions different from those which prevail elsewhere. Central London stocks are better this week, Districts and Metropolitans have both hardened, and Underground Electric Railway shares and income debentures are once more on the mend. London United Tramways Debenture rose 2, thus regaining half of its fall of last week. British Electric Traction issues remain weak. Three of the company's stocks have further receded.

It is a matter of incidental interest to observe that the Canadian Pacific has recently started to electrify short portions of its wonderful system, and an announcement this week speaks of a 5-mile tunnel in British Columbia which is to be thus treated. A further part of the same message adds that the first sea-going vessel electrically-propelled has been built for service in Canadian waters and will be used for the navigation of the Canadian canal system.

Electricity supply shares are amongst the few which have yet to benefit by the better tone prevailing in other departments. Possibly because the summer is coming on—as witness the snowstorm at the end of last week—the market for electric lighting shares is dull. City Preference were marked down $\frac{1}{8}$ the other day, but it was a mistake, and the quotation was restored to 12¼. County Ordinary, at 10¾, are ¼ lower. On the other hand, improvements of ⅛ have occurred in Charing Cross Ordinary, Edmundson's Preference and Westminster Preference, the last-named shares evidently attracting investment notice from the excellence of their security.

The Telegraph market is firm, with a steady inquiry for the principal issues. Anglo-American Preferred rose ½. Commercial Cable Debenture is 1½ higher. Indo-Europeans gained 30s. The Telephone section is equally steady. New York Telephone bonds continue to advance, and United River Plate Telephones are $\frac{1}{16}$ higher, but Oriental Telephones, at 1⅛, show a fall of $\frac{1}{16}$. Monte Videos are unchanged at 1½, upon the declaration of the usual interim dividend at the rate of 6 per cent. on the Ordinary. Telephone Company of Egypt, in paying 6 per cent. final dividend, makes its distribution 10 per cent. for the year. Constantinople Telephone shares are a little better, at 4½, for the £5 fully-paid shares.

Interest in the Marconi case is possibly waning a little, on account of the protracted nature of the proceedings and the somewhat technical character of the more recent evidence. The latter, however, has given the public some little knowledge of the way in which it is occasionally possible to market shares in a new company or a fresh issue, and affords an insight into the different "floors" upon which various sets of buyers are let into the good thing when it comes along. It must be remembered, however, that when people make big profits in the Stock Exchange, they usually do so by the taking of big risks, a point which it is well to bear in mind when considering the Marconi inquiry. Marconi shares are a little lower on the week, although the Preference are unchanged.

Anglo-Argentine Tramway issues are good, upon the excellent character of the report, following the declaration of an increase in the dividend on the Ordinary shares from 7¾ to 8¼ per cent. This has had the effect of raising the Debenture stocks, while the Second Preference at 5¾ are $\frac{1}{16}$ better. Brazil Tractions recovered 1¼. British Columbia Electric Deferred and Preferred are both higher, on the declaration of an interim dividend at the rate of 8 per cent. on the Deferred stock.

Mexico Trams, *ex* 1¾ dividend, are ¾ up on balance. Mexican Light and Power Common shares at 78⅜, *ex* 1 dividend, remain unchanged. Most of the Latin-Canadian issues are steady, and there is a fair demand for best class bonds. Montreal shares put on 3 points, but lost them and 2 more in addition. Allowing for their dividend deduction, Shawinigan Water shares are practically unchanged. The La Plata Electric Tramways' directors recommend a dividend at the rate of 6 per cent. per annum on the Preference shares, covering the period from July 1st to October 31st, 1911. Men in the market studied the announcement with grim interest.

The Manufacturing group is very quiet. India-Rubbers are 5s. better and British Westinghouse Debenture has been picked up, the price rising 3½ to 64. Babcocks eased off a little, and Armament shares are slightly on the dull side. Dick, Kerrs fell $\frac{1}{16}$. Rubber shares, after a temporary spurt, gave way on a fresh decline in the price of the commodity. The market is depressed, and is likely to remain so until something comes to the aid of the raw product to make the price better.

The affairs of the Northern Light, Power and Coal Company were ventilated at a general meeting held last Monday, when it was stated that arrangements had been made whereby the Canadian Klondyke Company undertook to lease the property of the Northern Light concern, and to guarantee a substantial annual revenue. Meanwhile the Northern Light 5 per cent. bonds remain at the nominal quotation of 10—20.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	6	9⅛ — 10⅛	..	5 18 5
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	10	8⅞ — 9⅛	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8⅝ — 8¾	..	3 18 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City Do. 4½ % Cum. Pref. ..	5	5	5†	4⅛ — 5	+ ⅛	5 0 0
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4⅝ — 4¾	..	4 14 9
Do. Do. 4 % Deb... ..	100	4	4	3⅞ — 4⅛	..	5 2 10
Chelsea, Ord.	5	5	4†	91½ — 93½	..	4 5 7
Do. 4½ % Deb.	Stock	4½	4½	4⅛ — 5	..	5 0 0
City of London, Ord.	10	8	9	96 — 99	..	4 10 11
Do. 6 % Cum. Pref.	10	6	6	16 — 17½	..	5 6 8
Do. 5 % Deb.	Stock	5	5	12 — 13	..	4 10 7
Do. 4½ % Second Deb. ..	100	4½	4½	116 —120	..	4 3 4
County of London, Ord... ..	10	6	6	100 —102	..	4 8 3
Do. 6 % Pref.	10	6	6	10½ — 11	— ⅛	5 9 1
Do. 4½ % Deb.	Stock	4½	4½	11½ — 12	..	5 0 0
Do. 4½ % Second Deb. ..	Stock	4½	4½	104 —106	..	4 4 11
Edmundson's, Ord.	£3	Nil	..	99 —102	..	4 8 3
Do. 6 % Cum. Pref.	5	Nil	3	5/16 — 7/16	..	Nil
Do. 6% Non-Cum. Pref. ..	5	..	..	4½ — 4⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	1⅜ — 2	+ ⅛	..
Folkestone	5	6	6	81 — 84	..	5 7 2
Do. 5 % Cum. Pref.	5	5	5	4½ — 5	..	6 0 0
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	5 0 0
Hove	5	9	9†	7½ — 7¾ xd	..	4 17 10
						5 16 2

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 8	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅜ — 1⅞	..	4 0 0
Do. 6 % Pref.	5	6	6	4½ — 5¼	..	5 17 1
Do. 4 % First Mort. Deb. ..	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4	4†	8⅜ — 8⅝	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	99 —102	..	4 8 3
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4½ — 4⅝	..	5 5 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97½—100½ xd	..	4 19 6
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¾ — 10⅞	..	5 11 7
Oxford	5	7½	6†	5⅞ — 6⅜	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6⅝ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	2	2	⅝ — 1⅛	..	..
South London, Ord.	4	5	6	2½ — 2¾	..	7 7 8
Do. 5 % First Mort. Deb. ..	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref..	1	7	7	1⅞ — 1¾	..	5 17 11
Do. 4½ % First Deb. Stock ..	100	4½	4½	94 — 97	..	4 11 3
Urban, Ord...	£3	Nil	..	⅛ — ⅜	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅛ — 3⅛	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	83 — 86	..	5 2 3
Westminster, Ord, ...	5	10	10	8½ — 9	..	5 11 1
Do. 4½ % Cum. Pref.	5	4½	4½	5 — 5⅛	+ ⅛	4 3 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5⅛	..	5 14 3
Calcutta, Ord.	5	8½	7†	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	93 — 95	..	5 5 8
Canadian Gen. El. Com. ..	$100	7	7	115 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —125	+ 1½	5 12 0
Cordoba Lt., Power and T., Ord.	1	3		1/16 — 3/16	..	5 14 3
Do. 5 % Deb.	100	5	5	93½ — 96½	..	5 3 8
Elec. Lt. and P. of Cochabamba, 4 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Bonds	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92½ — 94½	..	5 5 10
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	5/8 — 3/4	..	9 15 2
Kaministiquia Power, 5% G. Bs.	$500	5	5	101 —103	..	4 17 1
Madras, Ord.	5	Nil	..	1⅜ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	82 — 85	..	5 17 8
Mexican Lt. & Power, Common	$100	4	4†	77 — 80 xd	..	5 0 0
Do. 7 % Cum. Pref.	$100	7	7	105 —108	+1	6 9 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	92½ — 94½	..	5 5 10

Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	83 — 86	— ½	5 16 3
Montreal, Lt., H. and Power ..	$100	8	9†	223 —228	—2	3 19 0
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	105 —110	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	+2	4 8 3
Shawinigan Water, Capital ..	$100	5	5	137½ —142½xd	..	3 10 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	101½—103½	+ ½	4 7 0
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	97½— 99½	..	4 10
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	11¾d.	17¾d.	13/16 — 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	..	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7⅛	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	134 —136	..	5 17 8
Do. Collat. Trust	$1000	4	4	91 — 93	..	4 6 0
Anglo-American Telegraph ..	Stock	8	8	63 — 68	..	4 8 3
Do. 6 % Pref.	Do.	6	6	111¾—113½	+ ½	5 6 5
Do. Def...	Do.	80/-	..	24⅜ — 24⅝	..	6 1 10
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	99½—101½	..	4 18 6
Chili Telephone	5	7	8	7¼ — 7⅜	..	5 1 1
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	81⅛ — 83⅛	+1⅛	4 15 10
Cuba Telegraph	10	6	6†	8 — 9	..	6 9 9
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7	..	7 2 10
Direct United States Cable ..	10	5	4	6¾ — 7¼	..	5 10 4
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	135 —138	..	5 1 5
Do. 3½ % Pref. Stock.. ..	Do.	3½	3½	78 — 80	— ½	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	95 — 97	..	4 2 6
Eastern Extension	10	7	7†	12⅞ — 13⅜	..	5 4 8
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	93½ — 101½	+ ½	3 18 10
Globe Telegraph and Trust ..	10	6	6†	10⅝ — 11½	..	5 6 8
Do. 6 % Pref.	10	6	6	12⅝ — 13	..	4 12 4
Great Northern Telegraph ..	10	18	20	32 — 34	..	5 17 8
Indo-European Telegraph ..	25	13	5†	60 — 62	+2	5 4 10
Mackay Companies Common ..	100	5	5	83 — 86	..	5 16 3
Do. 4 % Cum. Pref.	$100	4	4	69 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	20	..	4⅛ — 4½	— ⅛	4 14 1
Do. 7 % Cum. Partic. Pref.	1	17	..	8½ — 8¾	..	4 10 8

Monte Video Telephone, Ord. ..	1	6	6†	1 — 1⅛	..	5 6 8
Do. 5 % Pref.	1	5	5	⅝ — ¾	..	6 14 8
New York Telep., 4½% Gen. Bnds.	100	4½	4½	99⅛—100⅛	+ ⅛	4 9 7
Oriental Telep. and Elec. ..	1	8	6†	1/16 — 1/8	— 1/16	4 2 6
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 5
Reuter's	10	10	10†	11¼ — 11⅝	..	8 10 2
Do. New Shares	10	..	..	10⅞—11	— 1/16	..
Submarine Cables Trust	Certs.	6	6	124 —127 xd	..	4 14 6
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 — 98	..	4 11 10
United River Plate Telephone	5	8	..	7 1/16 — 7 1/8	+ 1/16	5 4 0
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 9 0
West Coast of America	2½	2½	..	1¼ — 1⅝	..	4 3 4
Do. 4 % Debs., 1 to 800 guar. by Braz. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3 1/16 — 3 3/16	..	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9⅜ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	18 — 18½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	96 — 99 xd	..	4 11 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	*	Nil	Nil	3/16 — 5/16	..	Nil
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	74 — 79	..	5 14 0
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	8½ — 10½	— ½	..
Do. Do. Deferred ..	100	..	..	3½ — 5½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 88	— ½	6 16 4
Do. 7 % Non-Cum. Pr'f.	100	..	..	83 — 86	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	88½ — 92½	..	5 8 1
Do. 4½ % 2nd Deb. ..	100	4½	4½	75 — 79	..	5 13 11
Central London Railway, Ord.	100	8	8	80 — 82	+1	4 17 7
Do. Pref.	100	4	4	83 — 85	..	4 14 2
Do. Def.	100	2	2	79 — 81	+1	4 18 9
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & S. London, 5 % Pref., 1891	100	5	5	98 —101	..	4 19 0
Do. Do. 1898	100	5	5	99 —102	..	4 18 0
Do. Do. 1901	100	5	5	97 —100	..	5 0 0
Do. Do. 1903	100	5	5	95 — 98	..	5 2 0
Do. 4 % Deb.	100	4	4	94 — 96	—1	4 3 4
Dublin United Trams, 6 % Pref.	10	6	6	11⅞ — 12⅜	..	4 18 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅜ — 2⅝	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	7/8 — 1 1/8	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	66½ — 71½	..	6 5 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb. ..	100	5	5	73 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 3 4
London United Trams, 5 % Pref.	10	Nil	..	4/8 — 5	..	..
Do. 4 % Deb.	100	4	4	63 — 67	+2	5 19 5

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations April 15th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol. ..	*	1911.	1912.			
Do. Surplus Lands	100	1⅞	1⅝	58 — 58½	+1⅛	3 0 9
Do. 3½ % Deb.	100	2⅛	2⅛	61 — 63	..	4 7 4
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	81 — 83	..	4 4 4
Metropolitan District Ord. ..	100	Nil	Nil	39¾ — 40½	+1½	Nil
Do. 6 % Deb.	100	6	6	136 —138	+ ¾	4 7 0
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	98 —100	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	85 — 87	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	23/32 — 1 1/32	..	5 18 6
Do. 5 % Pref.	1	5	5	1 1/4 — 1 3/8	..	6 3 1
Do. 4½ % Deb.	100	4½	4½	87 — 91	..	4 18 11
Do. 5 % Deb.	100	5	5	91½ — 94½	..	5 5 10
Potteries, Ord.	1	3/8	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	1 3/32 — 1 5/32	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	84 — 87	..	5 3
South Metro. Trams, 6 % Pref.	1	6	..	1 1/16 — 1 1/8	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4¼ — 4½	+ ⅛	Nil
Do. "A"	1/-	..	..	5/16 — 7/16	..	Nil
Do. 6% First Cum. Inc. Deb.	100	..	6	109 —111	..	5 9 1
Do. 4½ % Bonds	100	4½	4½	97 — 99	..	4 10 11
Do. 5 % Income	100	1½	6 †	93 — 94	+1	6 7 8
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	3	3†	3⅛ — 3½	+ ⅛	4 0 0
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4 13/16 — 5 1/16	..	5 8 7
Do. 2nd Pref.	5	5½	5½	4⅛ — 4 7/16	+ 1/16	5 12 10
Do. 4 % Deb.	100	4	4	90½ — 92½	+1	4 6 6
Do. 4½ % Deb.	100	4½	4½	98½ —100⅝	+ ⅛	4 9 7
Do. 5 % Deb.	100	5	5	99½ —101½	+1½	4 18 6
Auckland Trams, 5 % Deb. ..	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜ — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	— 2	5 1 0
Brazilian Traction Light and Power	$100	..	6†	100⅜—102½	+1½	5 17 1
Brisbane Trams Invt., Ord. ..	5	8	8†	7 7/16 — 7 5/8	..	5 5 0
Do. 5 % Pref.	5	5	5	4 5/8 — 4 13/16	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def. ..	100	8	8†	135 —139	+1½	5 15 1
Do. Pref. Ord.	100	6	6	113 —118	+1	5 1 8
Do. 5 % Pref.	100	5	5	103 —106	..	4 14 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 6
Do. 4½ % Vancouver Deb. ..	100	4½	4½	100 —102	..	4 8 3
Do. 4½ % Con. Deb.	100	4½	4½	95 — 97	..	4 7 8
Calcutta Trams, Ord.	5	7	5†	5 3/16 — 6 1/16	..	6 12 0
Do. 5 % Pref.	5	5	5	4 3/16 — 5	— 1/16	5 0 0
Do. 4½ % Deb.	100	4½	4½	97½—100½	..	4 9 7
Cape Electric Trams	1	2½	..	1/4 — 3/8	..	..
City Buenos Aires Trams (1904)	5	5	5†	5 7/16 — 5 7/8	..	4 10 9
Do. 4 % Deb.	100	5	5	95 — 99	..	5 1 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	97 —101	..	4 19 0
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	3	25 — 35	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	15/32 — 17/32	..	..
Do. Pref.	1	6	..	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 1/4 — 1 3/8	..	4 7 3
Do. 6 % Pref.	1	6	6	1 — 1 1/4	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	103 —105	+1	4 15 3
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	96 — 99	—1½	5 1 0
Mexico Trams Com.	$100	7	7†	10 3/32 —110½ xd	+ 3/4	6 6 8
Do. Gen. Con. 5 % Bonds ..	..	5	5	93 — 95	..	5 5 3
Do. 6 % Bonds	100	6	6	98 —101	..	5 18 10
Para Elec. Rlys. & Lt., Ord. ..	5	10	10	7 — 7½	..	6 13 4
Do. 6 % Pref.	5	6	6	4 7/8 — 5 1/8	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1 3/8 — 1 11/16	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5 3/8 — 5 5/8	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds ..	100	5	5	95 — 96	+ ½	5 4 2
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	101 —103	..	4 17 1
Singapore Trams, 5 % Deb. ..	100	5	5	89½ — 87½	..	5 14 3
Southern El. Tr. B.A., 5 % Deb.	100	5	5	96 — 98	+ ½	5 2 0
Un. Elec. Trams Monte Video ..	5	7	6†	5 — 5½	..	6 7 3
Do. 6 % Pref.	5	6	6	4 7/8 — 5 1/8	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —101	..	4 19 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½—101½	..	4 8 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	1/16 — 3/16	..	8 0 0
Do. 6 % Pref.	1	6	6	3/4 — 7/8	..	7 2 2
Babcock & Wilcox	1	28	14†	5/8 — 13/16	— 1/16	4 6 5
Do. Pref.	1	6	6	1 3/8 — 1 1/2	..	4 0 0
British Aluminium, Ord. ..	1	Nil	..	1/16 — 1/8	..	..
Do. 6 % Cum. Pref.	1	Nil	6	1/2 — 3/4 xd	..	5 17 2
Do. 5 % Prior Lien Debs. ..	100	5	5	93 — 96	..	5 4 2
Do. Deb. Stk.	100	5	5	84 — 87	..	5 14 11
B.I. & Helsby Cables	5	10	10	7 3/8 — 8 1/4	..	5 15 11
Do. Pref.	5	6	6	5 1/2 — 6 1/2	..	4 16 0
Do. Deb...	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	8	Nil	Nil	1/2 — 3/4	..	Nil
Do. Deb...	100	4	4	63 — 66	+3½	6 1 3
Do. 6 % Prior Lien	100	6	6	98 —101	..	5 18 10
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb	100	4½	4½	38 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	25 — 29	..	16 13 4
Calender's Cable	5	15	10†	11 — 11½	..	6 7 8
Do. Pref.	5	5	5	4 7/8 — 5 1/8	..	4 17 7
Do. Deb...	100	4½	4½	98 —101	..	4 9 1
Castner-Kellner	1	20	20	8 1/16 — 8 1/8	..	5 5 3
Do. Deb...	100	4½	4½	103 —106	..	4 4 11

Crompton & Co.	8	Nil	..	1/8 — 3/8	..	Nil
Do. Deb...	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	5/16 — 3/8	— 1/16	..
Do. Pref.	1	6	6	3/4 — 15/16	..	7 18 10
Do. Deb...	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £8 paid ..	5	Nil	..	1/8 — 3/8	..	Nil
Do. fully paid	5	Nil	..	1 — 1 1/4	..	Nil
Do. 4 % Deb.	100	4	4	61 — 65	..	6 8 1
Do. 5 % Second Deb.	100	5	5	70 — 73	..	6 17 0
Electric Construction	2	2½	3½	1 7/16 — 1 5/8	..	5 14 4
Do. Pref.	2	7	7	1 15/16 — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7 3/4 — 8	..	8 5 8
Do. Deb...	100	5	6	92 — 94	..	5 4 2
General Electric, 6 % Pref. ..	10	5	6	10 — 10 3/4	..	5 11 7
Do. Deb...	100	4	4	88 — 93	..	4 6 0
Henley's, Ord.	5	15	15	12 3/8 — 12 5/8	..	5 17 2
Do. Pref.	5	4½	4½	4 5/8 — 5	..	4 7 10
Do. Deb...	100	4½	4½	101 —103	..	4 7 6
India-Rubber, G. & T.	10	..	7½	10 1/4 — 11 1/4	+ ⅛	6 13 4
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	17½	84 — 86	..	5 16 8
Do. Deb...	100	4	4	95½ — 98½	..	4 1 8
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 1/2	..	Nil
Do. Deb...	100	4	4	67 — 69	..	6 15 7

* Unless otherwise stated, all share are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 5 per cent., October 17th, 1912.

PRESERVATION AND PROTECTION OF STANDING TELEGRAPH AND TELEPHONE POLES.

[COMMUNICATED.]

Under the above heading a lengthy extract from the Canadian *Electrical News* appeared in the columns of the Electrical Review, on January 3rd, 1913 (page 33).*

In the opening paragraph it was asserted that "practically all poles fall at the ground line because of decay, and on account of this weakening at the base, have to be replaced or cut off and reset while the top portion is still sound."

It will be obvious to those engineers who are responsible for the renewal of pole lines in this country that such a statement must represent Canadian experience and not English practice. Scepticism as to its general application on this side of the Atlantic is still further increased by the following observation: "The average pole (cedar) has a life of about 10 years." Dealing briefly with the extracts referred to, it is scarcely correct to say that poles fall at the ground line because of decay; at any rate such occurrences are the exception and not the rule. The fact is that deterioration commences near the top of a pole and not at the ground line. A reason for this is not far to seek. Poles have to be notched for the reception of oak arms; these latter are usually secured in position by G.I. bolts which

Fig. 1.—Mode of Decay of Creosoted Poles.

Fig 2.—Creosoted Pole, dated 1900, carrying 68 Wires; Probable Life, 20 Years Longer.

involve as many auger holes through a pole as there are arms to equip. Moisture slowly percolates into each tiny aperture and eventually destroys the heart core of the timber; hence disintegration takes place from the apex downward.

In these circumstances a preservative coating, such as is recommended in the Canadian *Electrical News*, would neither prevent decomposition nor render innocuous the decay which may have already started. An interesting photograph (fig. 1) shows more clearly than words can describe the destructive forces that are at work. The pole from which these two pieces were sawn two years ago was branded "1882." Thus nearly 30 years' uninterrupted service has been registered; and when it is remembered that the pole in question was exposed to the fury of hail, rain, frost and snow during the whole of the time named, the record is not a bad one.

How does it happen that a pole of cedar wood in Canada can only be depended upon for a period of 10 years, whereas one of Norwegian spruce or of Baltic pine in England may be safely relied upon for 25 years? The answer is to be found in the utilisation of creosote oil. Nearly every pole in this country is creosoted, which renders it practically immune to climatic conditions. "Burnettising" and "boucherising" have been tried, but experience has shown that "creosoting" is far and away the best.

The process of creosoting consists of injecting creosote oil into the fibres under pressure. Trolley loads of poles, chained together, are wheeled into a long cylindrical tank, and after the cylinder end has been closed, oil is forced in by pumps to ensure the maintenance of the requisite pressure inside the tank. Owing to the brittleness imparted to the poles by this treatment and consequent liability to fracture when unloading them, it is not desirable that the timber should be completely charged with preservative oil. The quantity of creosote forced into poles is usually 8 lb. to the cubic foot of timber; and where the woodis perfectly seasoned and well dried this quantity will form a complete protective shell impervious to moisture.

Engineers agree that a pole should be pierced as little as possible; hence the practice of using climbing irons for gang purposes has fallen into disuse. For the same reason, pole testing axes have been recalled. A wise plan to discover whether a pole is subject to internal decay is to tap it with an ordinary hand hammer, when a peculiar hollow sound may be heard—difficult perhaps to explain, but never to be forgotten when once heard by those interested in the subject at issue. On odd occasions a gang joiner will report a defective pole, the condition of the latter having been discovered whilst using an auger for the erection of additional arms.

With a view to maintaining intact the protective shell of a creosoted telegraph pole, the Post Office Engineer-in-Chief stipulates that poles shall not on any account be notched near or below the ground line. This is all right as far as it goes, but it does not solve the real problem under consideration. Numerous efforts have been made to modernise the method of arming telegraph and telephone poles, but so far without success. In this connection the following incident is not devoid of interest. The late Mr. Langdon, of the Midland Railway Co., read an excellent paper before the Institution of Electrical Engineers, in April, 1896. During the discussion that followed, a representative of one of the leading railway companies in the British Isles is reported to have said: "I admit we have been in the habit of using this method of arming poles; but the writer has for some time been employed on a plan by means of which the timber of the pole shall remain intact both for ties and arms. The ties have been tried and found efficient, but the arms have not yet been finally arranged for."

The significance of the above quotation lies in the fact that the original system of arming poles is being pursued by that railway company to-day as merrily as ever.

If a creosoted pole could be yoked into service without having recourse to sawing and boring the upper parts, it is difficult, if not impossible, to say how long it would last; for, even with the present method of "rigging," its life may be relied upon to cover the period beyond which additions or alterations would justify its replacement.

* Our readers will, no doubt, recall the article in question from the fact that the heading was similar to the present one, and also because of a brief letter on the subject from Mr Wade adversely criticising it.

High-Pressure Underground Cables.—In the electrification of the Italian railways, extended use is being made of underground cables working at high pressures. A three-phase cable having a cross-section of 3 × 40 mm.², and working at 25,000 volts, is being laid in connection with the Milan-Lecco line, over a distance of 70 km., and a similar cable, with a cross-section of 3 × 50 mm.², 50 km. in length, is on order for the Giovi Ronco-Sanpierdarena Railway. The latter will be tested with 85,000 volts at the works of Messrs. Pirelli & Co., of Milan, who are the makers of both cables; and after laying, a test of 65,000 volts will be applied.

Wages and Condition at Aberdeen.—The *Scotsman* states that a mass meeting of electrical engineers was held in Aberdeen Trades Hall buildings recently to discuss grievances with regard to rates of pay, hours of labour, the question of overtime payment, &c. Complaint was made that no answer had been received to a thrice-repeated request to the masters for a conference, the first request having been made last October. It was eventually agreed to ask the masters for an increase of 1d. per hour in wages, raising them to 9d. and 10d. per hour, the latter for chargemen. The employers were requested to forward an answer by Wednesday, the 9th inst., and in the event of the demand not being conceded, and other matters considered, it was unanimously agreed that the employés strike.

THE FIRST INTERNATIONAL CINEMATOGRAPH EXHIBITION.

(*Concluded from page* 622.)

The B.T.H. exhibits included a variety of semi-indirect "eye-rest" fixtures, which are so well known that it is unnecessary to recapitulate their arrangement and advantages. A new type of

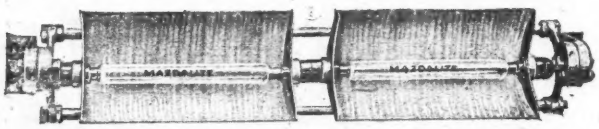
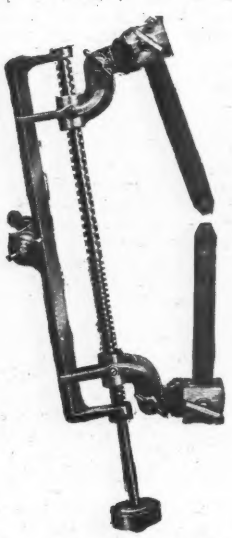


Fig. 4.—B.T.H. Concentrating Trough Reflector.

cornice troughing was exhibited for the first time. Parabolic reflectors of ribbed glass are mounted in swivel holders, from two to ten reflectors being carried in each frame, according to requirements. Along the focal axis of each reflector is mounted a 17-watt or 20-watt metal lamp, the maximum candle-power of the complete unit being 240 c.p. The inclination of the reflectors in the holding frames (which are screwed to the wall), is varied till even ceiling illumination is secured. The lamps are 1 ft. between centres, and a 6-in. hollow cornice conceals the whole fitting.

Among the other exhibits shown by this firm may be noted their 18-amp. lens and flood lamps for stage lighting. These are exceptionally light and convenient; the necessary ballast resistance is mounted in a ventilated case at the foot of the lamp standard, and connection with a strong and neat wall or floor pocket is effected by a flexible cable. Carbon feed is obtained by the rotation of a right- and left-threaded spindle, the screws on which are of equal pitch for A.C. and of 6 : 4 pitch for D.C. working. Only one size of carbon need be used whether working on D.C. or A.C. supply.



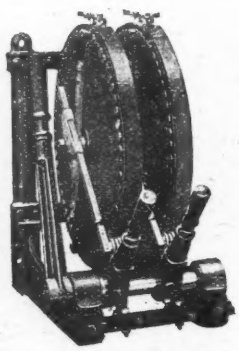


Fig. 6.—B.T.H. Dimmer (Two-Plate Bank Construction).

Fig. 5.—Rack for D.C. Lens Lamp.

For dimming purposes, an improved type of plate rheostat has been designed. This may be mounted flat on a wall, or any number of units may be built in a bank as shown in fig. 6. The plates illustrated have 50 steps (100-step plates are under construction), and the crank and rack control provided allows of very smooth regulation. A plunger in the handle of each plate lever enables the latter to be interlocked or disconnected from the horizontal shaft controlled by the master lever at the left of the bank. The rheostats will stand from 100° to 120° F. temperature rise indefinitely, and the plates are easily adaptable to two or three-wire circuits.

The "Indra" diffused lighting unit (exhibited by the E.E. and E. Co.), is now available in a variety of sizes and patterns. From the description of these fittings which has already appeared in these columns, readers will remember that the chief advantage secured is a single diffusion of all light emitted by the lamp, and hence higher efficiency than is possible in ordinary diffusing fittings where considerable multiple reflection and therefore absorption of light occurs.

Several firms exhibited electric programme number indicators, the chief recent improvements in which relate to the reduction of the number of wires required between the controller and the indicator. The crudest form of number indicator requires 42 interconnecting wires but, by suitable grouping of the lamps (as regards position and electrical connection), the Walturdaw Co. reduce the number of leads required to 25, while the Stage Equipment Co.'s indicator needs only 20 wires to show numbers 1 to 19 and "Extra" and "Deputy." In all modern indicators, a master switch is used for "1" in the double numerals. It is interesting to note that, on the Stage Equipment Co.'s systems, numbers 0 to 999 can be shown in 6-ft. numerals on four sides of an indicator by the use of 42 lamps and 38 wires, the latter being accommodated in a 1½-in. conduit. The addition of one wire and two lamps enables 0-1,999 to be shown.

The S.E. Co.'s footlight float is exceptionally shallow, and, the reflector being a single piece of sheet metal, behind which is all the wiring, it is possible to *wash* the reflectors with a water squirt. A hinged lid affords easy access to the wiring and holder connections.

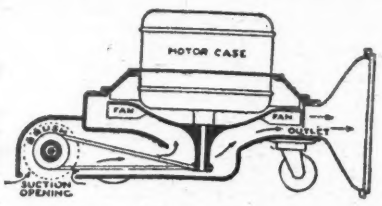


Fig. 7.—"Hoover" Suction Sweeper.

The float lamps (usually of 25-watt consumption) are mounted 6 in. apart, and, in order to insulate their holders from the reflector sheet, holes rather larger than the holder diameter are cut in the metal and fibre washers are fitted above and below the latter. The screw-rings on each holder are chamfered on their inner edges so that they are able to force together the projecting fibre washers and thus fill the annular clearance space between the holder and the sheet metal. The floats are carried on steel spring shock absorbers.

The same firm also exhibited a new type of batten carrying lamps on a Uralite strip and having a stout iron guard frame with a specially long "approach," the latter being designed to reduce the risk of abrupt collision in music-hall installations where drop scenery is crowded. The wiring of the battens is in a fire-proof chamber, instantly accessible through a removable metal cover.

The importance of electric chameleon and flashing signs to cinema halls was hardly adequately represented by the exhibits shown. Messrs. Whiteley showed good examples of Causton signs in the gallery, and the Walturdaw Co. exhibited their attractive "Autoray" sign consisting of an 18-in. diameter kaleidoscope group surrounded by "rays" of lamps, alternate ones of which are alternately extinguished so that the effect is produced of sinuous streams of light.

Cinema Switchboards.—A number of types of switchboards were exhibited suitable for use in cinema operating boxes. These boards varied considerably in the details of their arrangement, but generally comprised a main ammeter and voltmeter, a two-pole, double-throw switch (to change over from one projector to another while the first machine is being re-threaded), a voltmeter switch or tapper-key and fuse-boxes for the projector, pilot light and projector motor circuits. A switchboard shown by the Stage Equipment Co. offered the advantage that it practically formed its own wiring diagram, all the back connections being made by clearly traceable copper strip. Various types of regulating resistance frames were shown; for heavy current work and where the operator's comfort is studied, the unit type of rheostat mounted outside the operating chamber and controlled by knife switches offers obvious advantages.

Vacuum Cleaners.—The electrically-driven vacuum cleaner provides a most convenient and efficient means of cleaning all places of public assembly, and large numbers of these machines are already at work in cinema halls.

At the Cinematograph Exhibition, Messrs. Fyfe, Wilson & Co. demonstrated the working of their "Hoover" suction sweeper, which combines the beating and sweeping action of a rotating broom (having spiral lines of brushes), with the suction effect of a centrifugal fan. As shown in fig. 7, a ¼-H.P. vertical spindle motor, running at 3,800 R.P.M., is direct-coupled to a centrifugal fan, and drives the sweeping brush through a quarter-turn rubber belt. The latter and the motor brushes are easily accessible by removing a few screws. The usual cleaning tools can be attached by rigid or flexible piping to an adapter connected to the suction opening of the cleaner.

The "Imperial" vacuum cleaner, shown by the Electric Appliances Co., Ltd., weighs only 10 lb., and probably enjoys the distinction of being the lightest motor-driven machine on the market. A ⅛-H P. motor running at 7,000 R.P.M. drives a centrifugal fan, the discharge passage from the casing of which is carried in a continuous spiral to the filter bag connector. All the parts requiring inspection can be laid bare by the removal of six screws. A wick oil-cartridge attached beneath each motor-bearing carries six months' supply of lubricant, and the spindle-bearings are self-aligning (having $\frac{1}{32}$-in. play in their seatings). We understand that many of these cleaners are in regular use by the L.G.O. Co. and various railway and steamship companies and theatres. For so small a machine the suction exerted is remarkable.

The British Vacuum Cleaner Co.'s exhibits included several of their well-known motor-driven rotary pump equipments with Booth filters and fan-suction cleaners for lighter duties. The 2-H.P. rotary pump equipment mounted complete with starting gear on a small truck is specially suitable for theatre cleaning, the powerful suction available (25 in. vacuum against a closed nozzle) making possible thorough cleaning of thick seating, &c. It is hardly necessary to remind readers that this firm was the first to place vacuum cleaners on the market. Their products now include a

long series of hand and motor-driven machines ranging in capacity from 500 to 40,000 cb. ft. of air per hour (free inlet), and in price from 22s. upwards.

The recording cinematograph target exhibited by Life Targets, Ltd., constituted one of the greatest novelties of the Exhibition. The exhibit should have been arranged so that visitors could see exactly what the proposition was without paying 6d. entrance fee; the latter certainly included the right to six shots, but it ought to have been more easily evident what the target was. This was described in our issue of April 4th.

PROCEEDINGS OF INSTITUTIONS.

Colliery Cables.

By W. T. Anderson, M.I.E.E., M.Inst.M.E.

(*Abstract of paper read before the* Institution of Mining Engineers, *at Manchester, February 11th*, 1913.)

(*Concluded from page* 621).

On paper-lead-covered and armoured cables single suspenders of the clamp type have been successfully used, although the writer does not recommend them, unless very efficient protection is accorded to the lead. In the upcast shaft of the Pretoria Pit, Lancashire, such an arrangement withstood the explosion with practically no dislocation, although most of the boxing in was destroyed.

Fig. 8 is an illustration from a photograph taken by the writer, with the permission of the Hulton Colliery Co., Ltd.

Continuous vertical casing, since the issue of the new rules, need hardly be considered.

Methods of lowering shaft cables largely depend on the gear at hand and on shaft conditions. The safest way, from the cable point of view, is to fasten the cables by lashings or small specially-made clamps to a wire rope controlled by a haulage engine

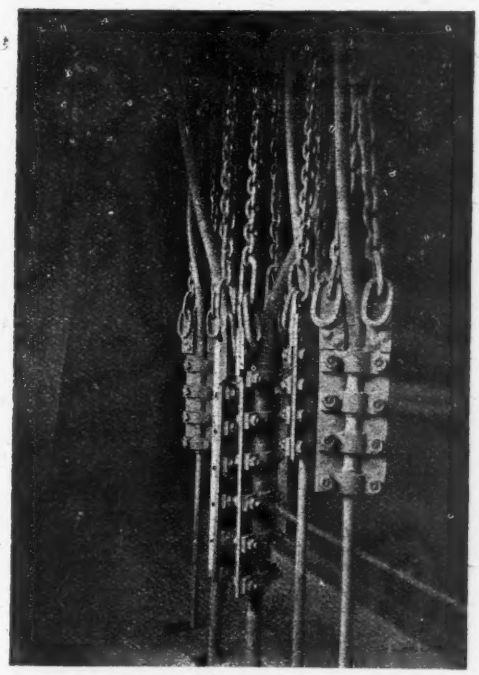


Fig. 8.—Single Suspenders of the Clamp Type, supporting Paper-lead-Covered and Wire-armoured Cables, at the Pretoria Pit

of sufficient strength and braking power to hold the necessary weight. Such engines are generally available, and the necessary guide pulleys for the wire rope are easily fixed up. The cable itself should be mounted close to the pit top and fed on to, and fastened to, the descending wire rope.

The best material for lashings is ordinary spun yarn $\frac{5}{8}$ in. or $\frac{1}{2}$ in. in diameter. The yarn should be used double, and each tie should carry about 1 cwt. of the weight of the cable.

An interval of 12 hours or so should elapse after lowering before cleating is commenced. This is especially advisable in deep pits, where the temperature at the top and the bottom of the shaft may vary to a considerable extent. Cases have been known of cleats being actually raised from their bearers by contraction of the cables.

Lowering direct from the cage with the drum slung either inside or underneath, can only be effected when there are no buntons in the shaft, or when cleats are attached to their outer sides. Means must be provided to check the revolving drum, in case the weight of the loop of slack cable should overbalance that of the drum.

Raising from the pit-bottom is only possible when the clearance in the shaft is sufficiently great to allow of a loaded drum being taken down. The method is rapid but objectionable, in that it amounts, for a period at least, to single suspension, with consequent strains.

Lowering direct from a capstan or a haulage-engine requires, perhaps, more care than any of the preceding, and should only be undertaken in the case of heavily armoured cables. Lowering should be continuous and without interruption, in order to avoid undue bearing strain against the jockey-pulley. When winding from the cable-drum to the engine-drum, the cable bend should form a C and never an S bend; and when the cable is used for any but the uppermost length in a shaft, great care should be exercised in winding it over the steel hawser and the couplings underneath it.

Lowering with a locomotive should only be adopted as a last expedient.

If the total underground load is shared between two or more feeders cases should be rare indeed in which both break down simultaneously. An even greater precaution is to install mains in different shafts, making their electrical connection below ground.

For roadway cables intake airways should be selected, and the position chosen for the run should be such as to afford the greatest security from mechanical damage. In main roadways where there are good walls and sound roofs, the cables may be fixed in a permanent manner by cleats. Where there is a liability of damage from falls, the cables should be suspended in such a manner and with so much slack that they will readily tear away without fracture. With this in view, many methods of slinging are adopted, the least reliable being, perhaps, the pig skin suspender, in which the eyelet is very prone to draw out, as the material deteriorates. Better far is the simple expedient of tarred marline fixed at regular intervals, not exceeding, say, 10 ft.

The writer noted a case recently where a paper cable was run on slings 800 yards in-bye with so little slack as to become as taut as a fiddle-string through the movement of the road. The joints were made without any boxes, and the mechanical strain, coupled with moisture at the unsealed end of the run, caused a very serious fire at that spot. Roadway cables more than any others are liable to come under Sec. *c* of Rule 12, and it may be mentioned that single-armoured cables (under certain normal conditions enumerated) will require to have their sheathings bonded together every 100 ft.; also that if two singles are so used, the conductivity of the sheathings of either shall be at least equal to 25 per cent. of the conductivity of the conductor enclosed thereby.

For installation purposes, it is advisable to take the new roadway cable down the pit intact on its drum, jacking it up on an improvised trolley running on tub-wheels, and paying out as the trolley moves along. If there is not room for the drum to be taken down the road, it must be jacked up and the cable drawn off and run in-bye on tubs, rollers, or pit-props, care being taken to avoid dragging it along the ground and so causing needless abrasion to the outer servings of jute.

If it is found impossible to get the drum down the shaft, the cable can be taken off at bank and lowered—either lashed to a haulage-rope or fixed to a capel—and run in-bye as it descends. In no circumstances should a twist or kink be allowed to occur.

The importance of the question of boxes cannot be overestimated, not only as seals to prevent moisture from entering the dielectric, but as means for making-off the armour in an electrically and mechanically sound manner, and of thus effecting continuity of the sheathings.

None but trained jointers should be employed on this type of work, and only the very best materials should be put in. If for reasons of general safety the sweating of cores cannot be undertaken, mechanical connectors, having an electrical conductivity not less than that of a sweated joint, should be used, care being taken so to protect such fittings with tape that the hot compound cannot creep into their crevices, with the possibility of ultimate sparking.

The fundamental features to be looked for in joint-boxes are absolute water-tightness and mechanical strength; long bearing glands; adequate means of bonding through from sheathing to sheathing; and such design as will reduce to a minimum the risk of cavities or "blow-holes" forming in the compound.

All pedestals should rest on porcelain feet immersed in the compound.

It is most inadvisable to joint actually in the shafts, but when it is necessary a vertical box must be used. Such a box should never be installed unless all dropping water can be temporarily diverted. Much the best method of arranging shaft joints is to make a horizontal connection in a heading or inset, even at the inevitable expense involved in the construction of such an inset. The most suitable box for this work is, undoubtedly, that of the horizontal type, in which the incoming and outgoing cables enter at one end, as illustrated in figs. 9 and 10. When it is desired to feed various levels from the shaft cable, a similar type of horizontal box may be used with an additional gland at its inner, or roadway, end. Such a box should be provided with disconnecting links, in order to allow of ease in testing. Boxes on lead-covered paper cables should have their glands "wiped" on to the leaden sheathing—an impossible matter, of course, in places where a blow-lamp cannot be used.

Terminal boxes are usually of the bifurcating or trifurcating type, and the question of protection of leads is one of some difficulty. The leads must certainly be metal-cased; when they must

be under one cover, a wrought-iron case constructed on site is perhaps the most suitable method to adopt. Alternatively a box may be provided, specially designed for use in any position, fitted with stuffing glands, and screwed so that barrelling, large enough to enclose three vulcanised india-rubber singles, can be fixed to the box. At the terminal ends of the rubber leads, fibrous tapes should never be allowed to come into contact with the metal of

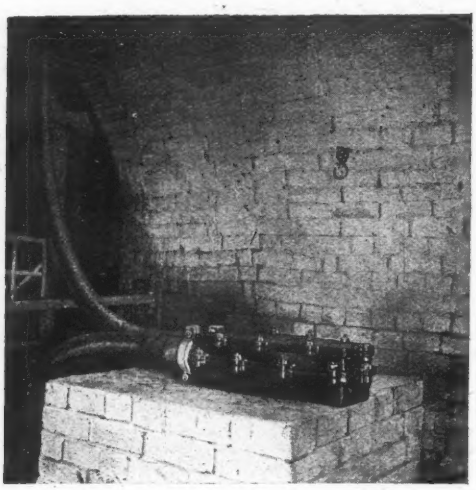


Fig. 9.—Single-ended Type of Horizontal Joint-Box (for fixing in an Inset) to connect up Shaft Cables.

lugs or conductors. The obvious method is to seal with material which will form a homogeneous water-proof covering from the cable trim to the lug. Not only will this arrangement facilitate the periodical work of testing, but it will minimise the risk previously mentioned of vagabond currents getting on to the metallic sheaths of the cables.

When joints are completed, the box must be filled up with an insulating compound, in order to protect the conductors and insulation from moisture. It is essential that this compound should be of high insulation resistance, that its consistency at the temperature at which it is poured into the box allows it to run freely, and that it sets hard, with no tendency to drain away from the box at normal temperatures.

For mining work the writer has always made it a custom to use only compounds suitable for extra-high-tension work, preferably with a high melting point, having a pouring temperature

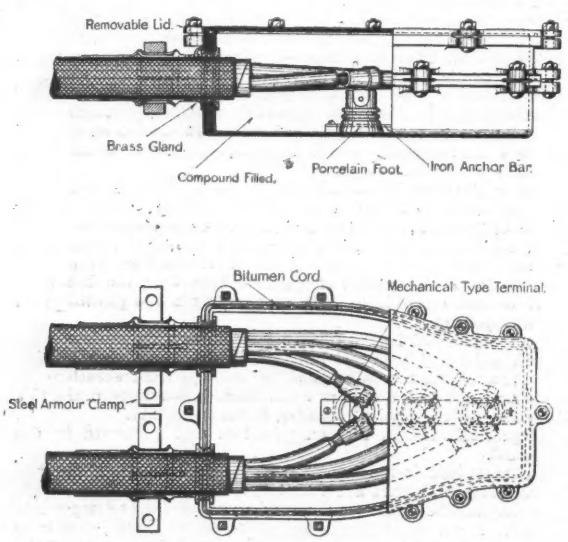


Fig. 10.—Details of Single-ended Horizontal Box.

of, say, 300° to 330° F. While overheating is injurious to the compound, it should never be used too cold, as the efficacy of the seal is thereby endangered. Enough attention is usually not given to this most important point. Not only should the correct pouring temperatures of any compound be ascertained, but jointers should always be compelled to use thermometers in order to gain such temperatures. Where heating cannot be done locally, it is necessary to get the compound rapidly transmitted from bank to box in some non-conducting jacket arrangement; the writer has seldom found much difficulty in effecting this, generally by placing large buckets in tubs filled with sawdust or some similar material.

The compound should be poured rapidly and continuously into the box, preferably through a funnel, and every facility should be given for air and gases to escape. It is essential that the boxes should be so efficiently filled that no cavities are left. If, on inspection after cooling, the box is found to be not quite full, final toppings are absolutely necessary.

As regards bonding and earthing, the new rules really enforce what manufacturers have been making their standard practice and generally recommending for several years past.

Rule 8 (*a*) provides that all sheathings, &c., "shall be earthed by connection to an earthing system at the surface of the mine.' In the memorandum, reference is made to the use of at least two earth plates, and the addition of a footnote, quoting the Board of Trade Tramway Regulations in this connection, suggests that compliance therewith would be in order. Those regulations provide for two plates not less than 20 yards apart, which "shall be constructed, laid, and maintained so as to secure electrical contact with the general mass of earth, so that, if possible, an electromotive force, not exceeding 4 volts, shall suffice to produce a current of at least 2 amperes from one earth-connection to the other."

This result is somewhat difficult to obtain with ordinary earth-plates; indeed, the writer has failed to accomplish it with copper plates, each of 2 sq. ft. area, laid in a bedding of coke, although the intermediate ground was well soaked with saline water. This, however, only demonstrates the wisdom and breadth of the rules, which, while indicating a high degree of efficiency, do not hamper its attainment by narrow or vexatious regulations that might easily be rendered abortive by local conditions.

Copper plates should be avoided on account of their rapid deterioration. Iron cylinders or pipes driven vertically into the ground and filled with breeze, into which engine cocks can drip, make perhaps the best job, provided that a sound and visible mechanical and electrical connection is made with them. As an alternative, a couple of old boiler plates thrown into a pond have often been known to give excellent results. It is always well, however, in addition to any earth-plates at the surface, to bond all metallic sheathings by means of three or four separate tinned-copper conductors made off with lugs to the flanges of pipes, known always to contain water, and forming a widely distributed contact with the main mass of earth.

In conclusion, the writer would put forward an earnest plea with respect to upkeep and maintenance. Nearly all the faults met with in his experience—barring those of a purely mechanical nature—have been due to carelessness, and could have been readily prevented. Rigid tests for insulation resistance, for continuity of sheathings, and for proving the efficiency of earth-connections, should be made in respect of all cables at least once a month, and their results recorded and compared. Deterioration, or even the result of unknown mechanical damage, may thus be traced before serious consequences ensue.

Discussion

Mr. H. V. Hart-Davis pointed out that last year there were 12 fatal accidents in mines due to electricity, as against 21 in the previous year, and the Electrical Inspector said that proper connections to earth might have prevented six of them; this showed the importance of efficient earthing. Instead of a separate earthing cable where transformers were used, he suggested a copper sheath under the armouring of the high-tension cable. In his opinion sufficient attention had not been given to lighting circuits underground; armoured cables should be used right up to the lamps.

Mr. E. Long referred to the recent paper by Mr. E. K. Scott, and deprecated the use of aluminium cables and wood casing in shafts. He preferred cleating at intervals to single suspension.

Mr. G. S. Corlett advocated paper-insulated cables for pressures of 3,000-5,000 volts. For lighting he preferred twin armoured conductors with joint boxes. In the case of a step-down transformer system, he pointed out that the probability of a heavy rush of current on the armouring of the high-tension cable was too remote to call for any special precautions.

Mr. W. B. Shaw said that the single-suspension clamps shown were of his design, and the method was particularly applicable to armoured lead-covered paper cables, but not very suitable for bitumen-insulated cables, except short ones.

Mr. A. F. W. Richards said that it was important that the actual requirements of the Home Office as regarded earthing in the case of a transformer installation should be ascertained.

Mr. J. D. Paton spoke in favour of due consideration being given to the advantages of aluminium for conductors, pointing out that though armoured cables were now required by law, the economic features of the question must not be disregarded.

Mr. S. H. Lee suggested that three locomotives and a number of wagons were not necessary to hold back a cable weighing 6 tons. He did not favour single suspension, as mines were now often 1,500 to 3,000 ft. deep. In sinking new shafts it would be advantageous to provide special space for the cables. For trailing cables, the cab-tire sheathed type had proved to be much superior to any other type. In the event of a dead short between the cores, the arc would not penetrate the sheathing. He referred to the advantages of putting the cables behind the timbers in a road, or burying them in iron pipes.

Mr. G. G. L. Preece said that bitumen-insulated cables could easily be made to withstand a pressure of 6,000 volts, but paper insulation underneath the bitumen was often used as an additional precaution. He did not recommend single suspension.

Mr. R. Nelson (Electrical Inspector of Mines) said he was very gratified to note that regulations which were designed primarily to secure safety appeared to the author to be successful, also in

assisting the manufacturer by "the standardisation of conditions." With Mr. Anderson's views in general, he expressed close agreement. Mr. Anderson recommended rubber-covered cables as "undeniably the best, both from a physical and from electrical points of view." Later, however, he remarked that bitumen-covered cables were "by far the most suitable for average colliery work." He could not mean that rubber-covered cables were the best "for average colliery work." If he had in mind what were usually called "tails," Mr. Nelson suggested that "making off or tailing cables" were obsolete below ground in mines. The best sphere for rubber-covered cables, if they had one at all below ground in mines, was in connections between controllers and resistance grids. Mr. Anderson mentioned the matter of the proper section of high-tension armouring where the current was transformed down at the shaft bottom, or elsewhere, for use in-bye. It should be remembered that the difficulty did not occur when the neutral point in both systems was earthed. To meet an insulated neutral point there was an alternative to Mr. Anderson's suggestion—namely, to fix earth plates at the junction of the two systems, and connect them in parallel with the surface earth by means of the armouring of the high-pressure cable alone, or, if the circumstances were thought to require it, in parallel with some other effective conductor. He supported the recommendation to "share the total underground load between two or more feeders." He would not expect two old boiler plates "thrown into a pond" to form a good earth connection. Water had an appreciable resistance, and he would expect to find that two buried boiler plates would give a better result. Mr. Anderson's last paragraph was a complete guide to proper maintenance.

Mr. W. T. Anderson, in reply to Mr. Hart-Davis, said that a reduction in the number of fatal accidents due to electrical causes of nearly 50 per cent. in the first year in which the electricity rules were in operation was their soundest justification. Mr. Hart-Davis's plea for a copper shield under the armour of high-tension shaft cables, in order to bring their lead-carrying capacity into line with the low-tension requirements below ground, was hardly feasible except in the case of lead-covered cables. In the event of pit water getting inside the armour, galvanic action would probably arise. The suggestion was otherwise distinctly sound, if only to avoid the danger set up by mechanical bonds between sheathing and an auxiliary earth wire, as it was most difficult to render these bonds efficacious. He agreed with Mr. Long's plea, that all colliery cables should be armoured (with the exception, of course, of trailers). This question of armouring had been disposed of by the new rules. Wooden casing had been mentioned by the writer, but dismissed by him as impracticable. His remarks applied equally to the split telegraph poles mentioned by Mr. Long. Rule 12 (D) happily put this suggested method entirely out of court. It was a method which was quite opposed to the spirit of the new rules. For normal conditions, in shafts, bitumen-covered cables without hygroscopic material of any kind in their internal construction were the best. He was inclined to agree with Mr. Corlett, that it was not electrically necessary to increase the high-tension armour as an earth connection to a low-tension system below ground; an earth on the low-tension might not affect the armouring of the high-tension system, but would probably be confined to the underground portion of the installation. Mr. W. Bolton Shaw, in referring to the single suspension at Hulton Colliery, had borne out the writer's remarks. The cables were light, and were of the one class which could be so treated without grave risk of injury. The writer could not, however, agree with Mr. Shaw that the clamp method of single suspension was good for paper-lead covered or for any other type of cable, and under no circumstances would he recommend its use. With regard to hydraulic pressure being set up at the bottom of paper-covered cables, this could not occur in cables the insulation of which was impregnated layer by layer and not in bulk. He had refrained purposely from any mention of aluminium for mining work, as he considered its use impracticable. The only form in which aluminium could be considered from motives of economy would be in the case of bare overhead lines. It was true that he had shown all his copper cores mechanically connected, for the reason that such connections catered for all eventualities. There could be no doubt, however, that sweated joints were to be preferred, and, broadly speaking, conditions allowed of their being so made in 50 per cent. of the mining boxes. For pit conditions of exposure to air and moisture the writer could not imagine a finer preservative for wood than creosote. Mr. S. H. Lee had suggested that three locomotives (two to lower and one as a stand-by) used to install a 6-ton cable were far from necessary. With this statement he could not agree. The stresses and safety factors to be provided for were impossible to gauge by ordinary calculation. Greasy rails, gradients, and local conditions might upset any ordinary precautions, and, as several recent accidents had shown (in one case where a couple of railway trucks accompanied the cable down the pit), it was much wiser to have a ton too much than an ounce too little, especially when the nose of the cable had to be followed down by men on the top of the cage. With regard to the capel, there was no question of lack of confidence in the more modern one made to the design of the cable makers. It was tested to 15 tons before being used for 6. Doubtless it was capable of taking something like 50 tons. The clamp was put on at the wish of the colliery authorities, and came in very handy as an anchor for the stand-by hawser. With regard to bare rubber-sheathed trailing cables, he was inclined to think that, although their initial cost was great, they had a great future before them. To thread considerable lengths of cable behind the timbering of roads was apt to do more harm in kinks and abrasions than would justify any increased protection, apart from the enhanced difficulty in clinging them satisfactorily in such a position. To bury roadway cables was undoubtedly bad practice, and one such successful attempt could not justify its adoption. The writer particularly welcomed Mr. Nelson's contribution to the discussion. For all main feeders (both shaft and roadway) installed under average conditions, rubber-insulated metal-sheathed cables were unquestionably the best. Their cost, however, rendered them quite prohibitive for ordinary commercial purposes. Next in suitability and generally efficiency undoubtedly came bitumen, which possessed many of the properties which rendered the use of rubber so excellent. Regarding the unsuitability of rubber for "tailing" purposes, it was, of course, clear that the ultimate desire of the framers of the new rules was to persuade manufacturers of switch-gear to provide on their apparatus suitable sealing chambers for the cables, and so do away with tailing cables altogether, a consummation which would be most heartily welcomed by the cable manufacturer. Perhaps if Mr. Nelson were to substitute the word "obsolescent" for "obsolete," he would describe more accurately the present position. In present circumstances where terminal boxes were provided the cores of cables going through them should invariably be cut. To continue through such boxes with the unprotected paper or bitumen-insulated cores (bifurcated or trifurcated therein) would be impossible: there remained then only rubber-insulated leads or bare metal. Such rubber-insulated leads provided the necessary mechanical strength. Under the new rules they were themselves enclosed in a metal sheath or tube (to a point presumably as near their respective studs as the tubing could be brought). The safest method of making them off to the lug was to provide the non-fibrous seal mentioned in the paper. Mr. Nelson's remarks regarding earthing by plates in water were interesting. It should, of course, be borne in mind that plates thus treated were not exactly surrounded by water, but were probably more or less sunk in mud. The recent report on electrical accidents, where high resistance in the earth-circuit had led to trouble, abundantly justified Mr. Nelson in the stand taken to ensure efficient connections to earth; and the writer could only add that if colliery engineers would armour, bond, and earth soundly, fatal mishaps below ground due to electrical causes would practically become unknown.

Electric Supply in London.

By Frank Bailey, M.Inst.C.E.

(*Abstract of paper read before the* Society of Arts, *April 9th*, 1913.)

The use of electrical energy as the motive power of our tube and other railways, for the working of our factories, and for lighting, heating, cooking, &c., has become so general that few of those who now participate in its advantages realise the difficulties that were experienced in the early days of pioneering a new industry. In 1890 I placed before this Society a short account of the progress of electric lighting in London, and I will now endeavour to bring this information up to date.

The Electric Lighting Act of 1882 limited all provisional orders to a period of 21 years. This short period did not encourage enterprise, and strenuous efforts to secure a sounder basis for the building up of a great enterprise resulted in the passing of the Electric Lighting Act of 1888, which extended the period to 42 years. Useful pioneering work was, however, accomplished between 1882 and 1888.

Up to the year 1890 none of the London vestries—now merged into borough councils—had decided to embark on municipal trading, with the exception of the St. Pancras Vestry, and it was not until the commercial success of the various undertakings had been established that 13 of the remaining borough councils in London applied for and obtained provisional orders. We ought therefore to appreciate the enterprise of the 13 companies who had undertaken the responsibilities of carrying out the obligations imposed upon them by the terms of the provisional orders granted under the Act of 1888. These companies had to raise the capital they required without being able to quote actual experience of a profitable yield; and it is remarkable, considering the inexperience of the industry at that time, how few mistakes were made, and how well the capital was expended. Most of the early pioneering plants have now disappeared, the capital cost having been redeemed out of revenue.

The table on p. 662 gives, in a summarised form, the present position of the various supply authorities in London. It shows the output for the 14 local authorities who work their own provisional orders, as published for the municipal year ending March 31st, 1912, and as estimated for the year ending March 31st, 1913. The output given for the 13 companies is taken from the published accounts, supplemented in many cases by information kindly supplied.

The total output includes some supplies given for railway and tramway purposes, within the area of the County of London, which, according to the census returns of the year 1911, contains 74,816 acres and a population of 4,521,685 persons.

To complete the statement so as to include all electric supply, reference must be made to the various railways and tramways operated by electric traction.

The total amount of electrical energy utilised for all purposes may be estimated for the year 1912 as follows:—

	Units.
Railways	271,500,000
Tramways	130,000,000
General supply	277,500,000
Total	679,000,000

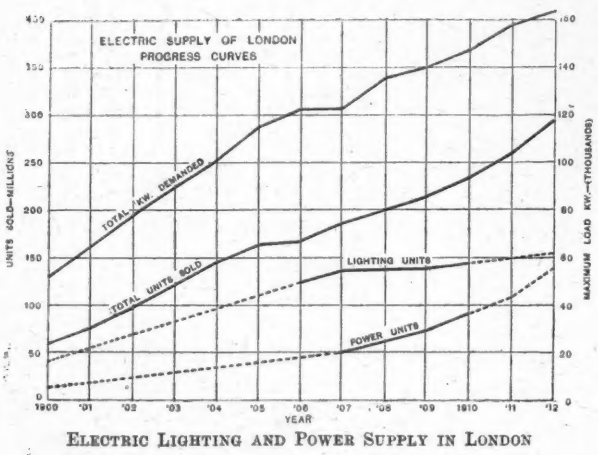
ELECTRIC SUPPLY IN LONDON.

Local authority.	Capital expended.	Units sold. 1911.	Units sold. 1912.	Max. load. Winter, 1912-13.
	£		Estimated.	KW.
Battersea	298,038	4,288,000	6,200,000	3,050
Bermondsey	181,172	4,144,438	4,600,000	1,960
Fulham	281,008	3,331,497	3,900,000	2,170
Hackney	356,394	6,615,520	9,800,000	4,290
Hammersmith ...	344,153	9,335,892	9,600,000	5,900
Hampstead	437,000	4,794,415	5,240,000	3,290
Islington	513,462	6,416,953	8,000,000	4,930
Poplar	302,468	9,193,872	12,000,000	5 250
Shoreditch	379,619	6,994,710	9,000,000	4,680
Southwark	108,673	1,790,983	3,000,000	1,700
Stepney	426,777	11,972,955	14,000,000	6,500
Stoke Newington ...	36,000	426,527	475,000	320
St. Marylebone ...	2,069,823	13,488,698	15,000,000	9 700
St. Pancras	557,468	9,452,067	11,376,000	3,740
Woolwich	310,000*	2,198,569	2,517,000	1,650
	£6,602,055	94,445,100	14,708,000	59,130
Company.				
Brompton	276,042	2,868,817	3,629,883	1,890
Charing Cross ...	2,340,762	27,118,199	27,657,296	13,990
Chelsea	490,301	4,016,478	4,184,072	2,800
City	2,000,324	26,633,759	27,488,860	18,510
County	1,885,648	20,450,787	22,512,478	12,800
Kensington	388,709	5,821,514	5,727,896	3,640
London	1,345,883	20,476,982	28,409,758	13,500
Metropolitan... ...	2,103,996	13,567,501	15,666,247	11,260
Notting Hill... ...	249,608	2,336,849	2,482,414	1,630
South London ...	403,310	4,479,487	5,000,118	3,130
South Metropolitan...	624,949	4,855,580	5,481,346	4,000
St. James'	426,398	10,708,689	11,044,768	5,950
Westminster... ...	1,252,630	19,868,622	18,638,125	10,880
Central (St. James' and Westminster Joint)	600,296	—	—	—
Wood Lane (Kensington and Notting Hill Joint) ...	224,340	—	—	—
	£14,613,196	163,203,264	177,323,258	103,980
Grand totals	£21,215,251	257,648,364	292,031,258	163,110

*Estimated.

NOTE.—Local authorities' accounts made up to March 31st each year. Companies' accounts made up to December 31st each year.

The progress of the supply authorities is shown graphically by the curves indicating the maximum demand and output in units. The influence of the advent of the metal-filament lamp is shown by the lighting output, any temporary depressing effect being more



ELECTRIC LIGHTING AND POWER SUPPLY IN LONDON

than neutralised by the increase in the sale of units for power purposes. The future demand for increased illumination from existing wiring, and the necessity for providing all the buildings with the necessary means for utilising this most efficient and economical light shows signs of steadily increasing and exceeding all estimates based on the old carbon-filament lamp. Between the years 1889 and 1904 every unit sold at from 6d. to 8d. could be utilised to obtain light up to 250 C.P. for one hour by using carbon lamps, or, say, 36 C.P.-hours for 1d.; now by using the tungsten lamp at the present moderate charges for supply, 1 unit will provide 833 C.P. for one hour, or say, 208 C.P.-hours for 1d.; or, in other words, the consumer obtains about six times the light for the same investment.

The Electric Lighting Act of 1888 did not contemplate the use of the electric motor, which was then made only in small sizes, and its great future was not realised by the public; but from 1890 to 1900 the utility of the electric motor was generally recognised, and pioneering efforts, involving much enterprise and patience, resulted in its gradual adoption and final universal use, with beneficial results to both supplier and consumer.

The electric supply authorities in 1906 combined to make an exhaustive canvass of all factory power users in London, and ascertained that the total amount of power required in all districts within the County of London was 208,806 H.P., or, say, 156,600 KW. The total connection for electrical power now amounts to about 135,000 KW., or 86 per cent. of all power required, and the increasing use of this power is shown on the curve.

From 1886 to 1900 the Willans engine was remarkable for the perfection of its design and the skill shown in its manufacture. The demand for generators of larger size placed the Willans engine at some disadvantage, and after the year 1900 the steam turbine took command of the field. The remarkable economy of the steam-turbine compelled many users to replace their Willans and other engines, securing not only more power for the same floor space, but also any amount of power from 500 KW. upwards.

The history of the steam turbine in this country is practically a biography of the life of the Hon. Sir Charles Parsons. In 1893 a Parsons turbo-alternator of 350 KW., then considered an enormous size, was constructed under exceptional circumstances, requiring quick manufacture and successful performance. A number of these machines were ordered to enable me to overcome complaints of vibration arising out of the working of reciprocating engines, and it became necessary to replace the latter by steam-turbines or to close the works. The result was successful; and while I must express the deepest gratitude to the inventor of the Parsons turbine, it is probable that the success of these machines encouraged the building of larger sizes and placed the turbine in the list of practical methods of electrical generation.

An interesting development is now being applied to the Parsons turbine in the form of speed-reducing gear, consisting of the employment of toothed gear wheels running in oil. It is better that the steam turbine should have a high speed and the generator a lower speed, and by means of this gearing the best conditions can be obtained without material loss or noise.

If we consider the wonderful progress of turbine design during the last 12 years, as proved by the fact that all reciprocating steam engines are now being superseded, we must recognise and appreciate

BIRD'S-EYE VIEW OF LONDON'S ELECTRICAL CENTRE OF GRAVITY.

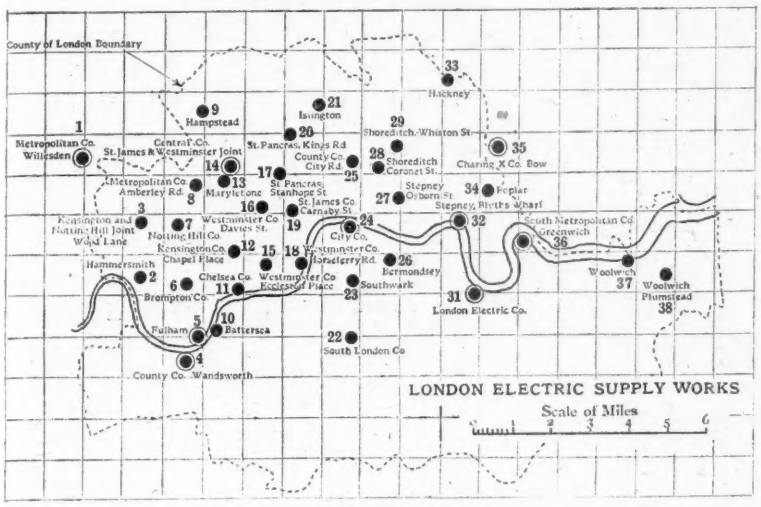
the work of Sir Charles Parsons in startling the world with a revolution in mechanical science. There are many makers of turbines of various types, but, whether adopting the Parsons principle or some variation of it, their existence is due to the indefatigable pertinacity with which Sir Charles Parsons overcame all pioneering difficulties until he revealed the possibilities of a great commercial success.

Prior to 1888 the steam boilers used in this country were of the cylindrical type, and the water-tube boiler came to us from America, with the usual prejudice to overcome. In the capable hands of Messrs. Babcock & Wilcox, the water-tube boiler established itself as the safest and most economical means of obtaining a high steam pressure, with an integral superheater capable of raising the temperature of the steam to the highest limit permissible in the steam turbine.

The Babcock Co. have also done good service to the electrical industry of this country by perfecting an automatic stoker of the chain-grate type, which can be arranged to burn any kind of fuel —from Welsh small coal to the softest coal obtainable.

One effect of the great improvements in steam-generating plant is that the 257 million units sold in 1911, together with the units expended in distribution and for works purposes, were obtained by the consumption of about 570,000 tons of coal. If the present use of electrical energy were replaced by the old method of a separate

steam plant for each power user the amount of coal required would be at least 1,000,000 tons per annum more than at present, and the wasteful consumption of this increased quantity of coal would result in a repetition of the dense fogs which were so prevalent before the introduction of electrical supply. It must also be remembered that the distribution of power by means of underground mains has removed from the surface of the streets a large number of coal-carts which formerly supplied the needs of power users, and also the necessary dust-carts to remove the ashes.



Electricity Works Supplying London.

It has been suggested that large electric power works in the coal-fields or down the river would, by superseding all the existing generating works, secure some economy in the costs of generation. Such economies can easily be shown on paper, and it can with equal ease be demonstrated that the additional cost of mains and losses in transmission more than counterbalance any hypothetical economy in generation.

London is at present supplied from 38 generating works, the positions of which are shown on the plan. Many of the works are equipped with plant of the latest design and best economy, and, having facilities for extension at low capital cost, it would appear to be wiser to convey coal to them rather than to provide expensive copper mains from distant works. Some of the existing works have sites of the utmost value to the future supply of London, and, so long as the centre of gravity of the whole demand falls at a hypothetical point not far from the south side of Blackfriars Bridge, it is clear there is greater economy in developing works on all sides of this point rather than the concentration of the load in a distant region.

(To be concluded.)

MAINTENANCE COSTS OF ELECTRIC TRACTION.

Our contemporary, the *Railway Gazette*, in a recent article by its Berlin Correspondent, gives the following interesting figures in connection with maintenance costs on German electric railways :—

The annual mileage figures depend essentially on the use that has been made of the traction equipment, and this, of course, differs on the several systems. Whilst on the City railways the average amounts to 56,000 motor car-miles, on the suburban lines, where, besides the ordinary local traffic, mixed trains are also hauled, the average amounts to 20,000 or 25,000 car-miles. The following are some fairly comparable results for the different railway systems regarding the wear of certain parts of the electrical equipment :—

The wear of the carbon brushes varies from 2 to 8 mm. per 1,000 car-miles, according to the type, number of revolutions of the motor, and amount of attention given. How far equalising connections in the commutator could diminish wear has not yet been definitely established.

The commutators must be ground or turned down on an average after about 20,000 to 30,000 miles ; distances of 36,000 miles have been accomplished without undue wear of the collector. Too great a wear of the commutator would cause the insulating material to protrude between the commutator bars, and flat places to form themselves on the commutator, resulting in considerable wear of the carbon brushes. Commutators of the usual dimensions used in single-phase motors must be completely renewed after about six years. The armature bearings, if carefully attended to, are renewed after about 24,000 to 30,000 miles.

The data as to the wear of the gear wheels vary considerably On one railway with infrequent stops the small gear wheels of the motor have lasted over 100,000 miles without requiring replacement. Each small gear wheel made about 120 million revolutions. On interurban and city railways the same wheel had to be changed after about 80 million revolutions, in other words, after about 24,000 or 36,000 car-miles, according to diameter of wheel, &c. The Prussian State railway management requires a guaranteed minimum of 24,000 miles for the small gear wheels and of 48,000 miles for the large gear wheels. As a matter of fact, distances of 120,000 miles have been accomplished without the large gear wheels needing replacement.

In like manner the wear of the bow of the current collectors varies considerably. Much depends on the material of the bow, on the amount of traffic, on the position of the rails, and on the construction of the overhead line. Aluminium bows, most commonly used, have, before needing to be changed, covered distances on interurban lines of from 2,000 to 3,600 miles, the overhead line being of simple construction. On main railway lines where trains are still hauled by steam locomotives, causing the wire to rust, the average life of the bows is about 4,000 to 5,000 miles, and on main lines with electric traction only it is about 9,000 to 12,000 miles.

Electrically or pneumatically-worked contactors have been very successful, the switch contacts having stood 6,000 short circuits before needing to be replaced.

In the case of the transformers on a city and suburban railway the internal insulation had to be changed after six years—*i.e.*, after about 35,000 miles—because it began to crumble or break. The insulation of the coils themselves, however, was still good.

On the same railway the overhead wire was also changed after six years. The original copper cross-section of 90 sq. mm. had been worn about 40 per cent., so that there was still 60 per cent. of copper left. However, it was not deemed advisable to allow a greater wear in order to avoid increasing the drop. There was a daily traffic beneath the overhead line of about 220 trains, each with four bows, so that the wire was changed after about two million bows had passed along it.

The maintenance costs of the motor-cars (six-axle cars with two 200-H.P. motors) were, on the above-mentioned railway, about 2d. per car-mile, three-quarters of which is to the account of the electrical equipment. The average annual maintenance costs of four-axle motor-cars (four 70-H.P. motors) of an interurban railway are also given as about 2d. per car-mile. The working costs on other lines are still smaller, but then it must be borne in mind that electric traction has only been recently introduced there, so that the motors and equipment are still under guarantee and the makers bear a share of the working expenses.

COPPER.

The importance of copper to modern industries is shown clearly by the figures tabulated in Messrs. Merton's schedule of principal copper supplies, which gives the world's output, and the outputs of the principal copper-producing countries, for the last 20 years, including 1912. We see from this that, whereas the world's output in 1893 was a little over 300,000 tons, it had increased to over half a million tons in 1901, and was doubled in the subsequent decade, the total output for 1912 being 1,004,485 tons. Allowance must, of course, be made for the fact that, of late years, statistics on the subject have been more carefully compiled, and countries whose output, while small, was not included, have only come on the list with a fairly high figure, which may be responsible for some of the sudden leaps taken by the totals. For instance, while the average annual increase over the ten years 1893-1902 was 27,000 tons, the difference between the output for 1899 and that for 1900 was only 7,270 tons, while that between 1898 and 1899 was 42,618. This, however, may be traced to high prices in 1899 stimulating production, which, in the ensuing year, reached its limit for the time being. Between 1903 and 1904 there is the remarkable difference of 69,225 tons. The American mines, principally those of Montana, increased their output considerably in 1904, besides which Mexico was estimated to have advanced 5,000 tons, Namaqua was 1,700 tons up, Australasia 5,000, and Japan 3,500. The high prices of 1907 further stimulated production, the effects showing themselves in 1909, which advanced 85,245 tons over the preceding year ; 66,980 tons of this increase was put out by United States concerns. The following year the United States showed a decrease, and the increase for 1911 was only 7,645 tons. After this comes the largest increase of all, 132,565 tons for last year. The United States figures show an increase of 70,970 tons, Japan has 10,000 tons, Chile nearly 8,000, Canada 10,000, Australasia 6,000. Of the total, the favoured Continent yielded '66, South America '07, Europe '11 ; Japan with 65,500 tons, and Australasia with 47,000, were the only other contributors of much consequence.

Looking over the columns, Australia and Canada show good, steady increases, Australia having doubled in 12 years, and Canada

in 10. Chile had its highest output last year, and Germany makes slow, but steady, increase. Japan has a most gratifying progress, very steady; Norway is now over 10,000 tons; there is a good show in Servia's 7,240 tons, and Russia made a strong advance last year. Spain and Portugal also show a considerable increase after five years of much the same figures.

Messrs. Merton's table shows that the output of the following countries exceeds 10,000 tons:—Norway and the African mines; over 20,000, Germany and Peru; over 30,000 Canada, Chile and Russia; over 40,000 Australasia; over 50,000 Spain and Portugal (taken together); over 60,000 Japan; over 70,000 Mexico.

In connection with the above figures, the information to be found in the chairman's speech to the fourth ordinary general meeting of the Rio Tinto Co. is of considerable interest to consumers as well as producers. Mr. C. W. Fielding, who occupied this position, alluded to the high prices ruling in 1906 and 1907 as "unhealthy," as unduly stimulating production and bringing into the market excessive supplies, which kept the price down subsequently. In 1911, however, stocks began to come down, and in 1912 they were almost too low, and the price at one time rose temporarily to over £80. The price has been low this year owing to the unsettled state of European politics keeping the buyer from the market. Supplies would thus, after sound financial conditions in a country, appear to be, if not the determining factor in price, at any rate a good indicator of tendency.

Messrs. Merton's monthly circular is now to hand, and shows European supplies (excluding Rotterdam, Hamburg and Bremen) as 32,261 tons, a withdrawal of 3,885 tons during the month. Of this 1,410 tons are from English ports, the remainder of the reduction being on quantities afloat and at Havre. Including Dutch and German ports, the supplies are 45,074 tons, or an increase of 401 tons, and there are estimated to be 2,500 tons more at other European ports.

Arrivals from North America to Europe have been strong at 29,770 tons. Spain and Portugal contributed rather less than average to England and France, but more than usual to other countries. Chile shipments are just below average, and Australian lower than usual. Total deliveries, at 42,927 tons, are medium, the average for the past 12 months being 41,500.

American stocks at the end of February were 54,600 tons, or 400 less than at the end of January. Total visible supply for the end of February was 99,273 tons, 1,172 tons better than at the end of the preceding month.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

7,530. "Number impulse instrument for automatic telephone systems." Siemens & Halske Akt.-Ges. (Convention date, March 29th, 1912, Germany. March 31st. (Complete.)

7,531. "Supervisory circuits for telephone systems." Siemens & Halske Akt.-Ges. (Addition to 7,180, 1913; Convention date, March 30th, 1912, Germany.) March 31st. (Complete.)

7,544. "Control for electrical systems." C. F. Kettering. (Convention date, August 9th, 1912, United States.) March 31st. (Complete.)

7,545. "Selective electrical distribution systems." C. F. Kettering and W. A. Chryst. (Convention date, November 20th, 1912, United States.) March 31st. (Complete.)

7,546. "Control for electrical systems," C. F. Kettering. (Convention date, November 11th, 1912, United States.) March 31st. (Complete.)

7,561. "Electrically controlled valves." W. C. S. Chapman. (A. D. Chapman, Cape Colony.) March 31st. (Complete).

7,570. "Electric warp stop motions for looms." J. Hancq. March 31st. (Complete.)

7,581. "Luminous switch handles or the like." H. Wade. (Voigt and Haeffner Akt.-Ges., Germany.) March 31st. (Complete.)

7,585. "Signal systems for railways and apparatus for use therewith." E. C. R. Marks. (W. H. Gilman, United States.) March 31st.

7,593. "Combined intercommunication and party line telephone systems and the like." Sterling Telephone and Electric Co., Ltd. (Telephon Fabrik Akt. Ges. vorm. J. Berliner, Germany.) (Divided application on 6,580 of 1912, March 16th, 1912.) March 31st.

7,600. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., F. H. Clough and L. Dunker. March 31st.

7,610. "Transmitting apparatus for use in wireless telegraphy and telephony." G. Marconi and C. S. Franklin. March 31st.

7,638. "Electric bells or gongs." F. F. MacDonald. April 1st.

7,640. "Galleries or carriers which support shades or globes for gas and electric incandescent lights." J. N. Mollett. April 1st.

7,656. "High-tension duct-insulator with safety fuse." A. Bitter and E. Weissberg. April 1st.

7,670. "Telephones." C. F. Killar. April 1st.

7,675. "Means of producing electrically effects corresponding to the form, density, or other physical qualities of bodies." F. A. Heron. April 1st.

7,722. "Incandescent electric lamps." T. W. Lowden. (Addition to 1,180/12.) April 2nd.

7,750. "Electrical apparatus for heating and cooking." E. W. Lancaster. April 2nd.

7,755. "Form of contact for electric bells, alarms, and the like." J. H. Cunnington. April 2nd. (Complete.)

7,756. "Electric switches." R. H. Barbour and E. Schattner. April 2nd. (Complete.)

7,776. "Electric alternating-current machines." Allmanna Svenska Elektriska Aktiebolaget. (Convention date, April 6th, 1912, Sweden.) April 2nd. (Complete.)

7,784. "Dynamo-electric machines." Allgemeine-Elektricitats-Ges. (Convention date, April 2nd, 1912, Germany.) April 2nd. (Complete.)

7,795. "Dynamo-electric machines." E. Middlebrook and H. Smith. April 2nd.

7,802. "Actuating gear for magnetos and dynamos for electric ignition." E. H. Micklewood. April 3rd.

7,805. "Electrical conductors and supporting means for same." British Insulated and Helsby Cables, Ltd., W. M. Mordey, J. W. Astley and D. B. Saunderson. April 3rd.

7,838. "Time switch." J. G. Mehne. April 3rd. (Complete.)

7,840. "Construction of electrical dynamo with counter compounding." J. Peugeot. April 3rd. (Complete.)

7,842. "Driving of looms by electric motors." Siemens-Schuckertwerke G.m.b.H. (Convention date, April 3rd, 1912, Germany.) April 3rd. (Complete.)

7,846. "Means of housing the recording strip of electro-cardiographs or the like." Siemens & Halske Akt. Ges. (Convention date, April 6th, 1912, Germany.) April 3rd. (Complete.)

7,847. "Wireless-controlled vessels." R. Cartwright. April 3rd.

7,896. "Regulation of electric motors by means of boosting and bucking machines." Allgemeine Elektricitats Ges. (Convention date, April 3rd, 1912, Germany.) April 3rd. (Complete.)

7,918. "Enclosed electric switches." V. Hope. April 4th.

7,931. "Electric conduits and the like." F. S. Rippingille and F. L. Broughton. April 4th. (Complete.)

7,932. "Electrical heating bodies composed of non-metallic resistance materials." Gebruder Siemens & Co. (Convention date, April 11th, 1912, Germany.) April 4th. (Complete.)

7,933. "Automatic electric direction and danger indicator for mechanically-propelled vehicles." A. R. Davy, A. W. P. Fellows and T. M. Jones. April 4th.

7,949. "Electric arc lamps." A. S. Long. April 4th.

7,977. "Detectors for use in wireless telegraphy." Graham & Latham, Ltd., L. J. Graham and B. F. Sobatka. April 4th.

7,983. "Arrangements for starting and regulating direct-current electric motors." F. Cumont. (Addition to 8,108/12.) April 4th. (Complete.)

7,994. "Speed-indicating apparatus." Chadburn's (Ship) Telegraph Co., Ltd., and J. Howie. April 5th.

7,996. "Sealing terminals and connections for electric cables." F. A. Cortez-Leigh and G. Broughall. April 5th. (Complete.)

8,024. "Telegraphic transmitters." W. E. Shaw. April 5th. (Complete.)

8,057. "Arrangement of current transformers for high voltages." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt. Ges., Germany.) April 5th. (Complete.)

8,083. "Production of gases by electric arc." R. Haddan. (International Ionizing Process Co., United States.) April 5th. (Complete.)

8,054. "Ship signalling or telegraph apparatus." J. Storey. April 5th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Timing Devices for Making and Breaking Electric Circuits and for other Purposes. H. S. Hatfield. 6,404. March 14th.

Vapour Electric Apparatus. M. A. E. Leblanc. 6,655. March 18th.

Distance-operated Mechanisms and Signals on Electric Supply Systems. H. W. Handcock, A. H. Dykes and W. Duddell. 6,716. March 19th.

Electric Transmitting Mechanism for Marine Engine Governors. S. Rumolino. 6,828. March 19th. (Addition to No. 29,754 of 1909.)

Automatic Electric Circuit-breaking Arrangements. E. Möller. 6,990. March 21st.

Signalling by Means of Electro-magnetic Waves. F. J. Chambers. 7,242. March 25th.

Protective Devices for the Conductor Rails of Electric Railways. C. H. Merz and S. G. Redman. 7,591. March 28th. (Addition to No. 11,347 of 1908.)

Slip-ring Collector Devices for Electrical Instruments and Machines. A. Denny and F. T. Edgecombe. 8,640. April 12th.

Electric Coupling or Connection Fixtures. S. Trood and J. H. Dale. 9,809. April 26th.

Electric Photographic Printing or Copying Frames. J. B. Halden. 10,183. April 30th.

Vacuum Electric Water-heater. J. Mann. 12,867. May 24th.

Electrical Apparatus for Medical and other Purposes. C. H. Ivinson and G. Bryant. 12,757. May 30th.

Friction Clutch Gear for Use in Electric Boat-hoisting Apparatus. J. Fielding. 12,892. June 1st.

Means for Selectively Operating One or Several of a Series of Electrical Devices. A. Schmid. 14,121. June 17th.

Electric Induction Heater or Furnace. A. Helfenstein. 14,164. June 17th. (June 16th, 1911.)

Protective Devices for Electric Circuits. British Thomson-Houston Co. (General Electric Co.) 16,708. July 17th.

Electric Therapeutic Appliances for the Soles of Boots, Shoes and the Like. G. Wilson and C. J. Wilson. 16,758. July 18th.

Apparatus for Reproducing Undulatory Electric Currents. J. Schiessler. 18,655. August 14th. (Convention date and Patent of Addition not granted. Divided application on No. 4,061 of 1912, February 17th.)

Contact Devices for Controlling Points or Signals on Electric Tramways and the Like. J. J. H. W. Weenen, H. W. G. J. Stoffels and J. B. van der Sprenkel. 19,160. August 21st.

Spark Plugs. J. J. Thompson. 20,248. September 5th.

Automatic Electrically-operated Elevators. R. Liljeblad and Aktiebolaget Elevator. 24,918. October 19th.

Production of High-frequency Currents adapted for Use in Wireless Telegraphy and Telephony. W. P. Thompson. (Compagnie Universelle de Telegraphie et de Telephonie Sans Fil.) 24,937. October 31st.

Means for Electrically Transmitting and Indicating Orders, Signals, Information or the Like. C. J. Evans. 26,694. November 20th.

1913.

Means for Regulating the Output of Dynamo-electric Machines. T. W. Tattersall. 1,205. January 15th.

Electrical Resonance Apparatus. H. W. Handcock, A. H. Dykes and W. Duddell. 5,307. March 3rd. (Divided application on No. 6,716 of 1912, March 19th.)

Differentially-wound Compound Dynamo-electric Generators. C. F. Kettering. 5,515. March 5th. (May 22nd, 1911. Divided application on No. 8,794, February 15th.)